CALIFORNIA JOURNAL OF SECONDARY EDUCATION

170 SOUTH VAN NESS AVENUE, SAN FRANCISCO, CALIFORNIA

Vol. 20, No. 7 November, 1945

IN THIS ISSUE

EFFORTS TOWARD THE IMPROVEMENT OF MATHEMATICS TEACHING

A symposium based on recent state and national reports on the teaching of mathematics and including the following articles: "Re the California Report on Mathematics," "Reactions to the National Report on Mathematics," "Some Problems in Secondary School Mathematics," "The Manner in Which Pupils Learn Mathematics," "Mathematics in Elementary Schools," and "Mathematics in General Education." Professor Raleigh Schorling of the University of Michigan writes an accompanying article, entitled "A Program for Learning Aids."

TRENDS IN PARENT EDUCATION

An interesting discussion of how parent education can be made truly the hope of both the present and the future, written by C. Edward Pedersen, principal of the Berkeley Evening School and Parent Education Classes.

HIGH SCHOOLS NEED MORE GEOGRAPHY

An article by George W. Ott of the Hollenbeck Junior High School, Los Angeles, outlining the importance of the study of geography in the high schools of today.

WHERE ARE WE GOING IN SECONDARY EDUCATION?

In this article, Dr. Reuben R. Palm, director of the Division of Secondary Education, Los Angeles County Schools, discusses certain trends in secondary education today.

IN DECEMBER

COMMON PROBLEMS OF THE STATE COLLEGES AND SECONDARY SCHOOLS

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The California Journal of Secondary Education is published by the California Society of Secondary Education in eight numbers during the year and is issued in the calendar months of January, February, March, April, May, October, November, and December, from the office of publication at 170 South Van Ness Avenue, San Francisco, California. One dollar and fifty cents of each membership fee in the Society is for a year's subscription to the Journal. Subscription to nonmembers is $3.00 per year; single copies, 50 cents. Annual subscriptions in all countries in the International Postal Union, $3.25. Members and subscribers are requested to report at once any change of address, giving old as well as new address. Entered as second-class matter at the post office at San Francisco, California, under the Act of August 24, 1912.

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Lassen Junior College Trains Italian Prisoners

A WAR-TIME English project at Herlong, California, has been carried on by the Lassen Junior College for the past year. Herlong, an army munitions depot forty miles distant from Susanville, home of Lassen Junior College, employs some 250 Italian allied soldiers, who are engaged in loading ammunition for the United States Army.

The need for teaching these men the English language arose with their arrival, and so Lassen Junior College undertook the job. At first the classes were not obligatory, but the army now compels attendance. Beginning with thirty-five men and one teacher last fall, the project now involves around two hundred fifty men and seven teachers. Soon 100 more men are expected to arrive, and accordingly more teachers will be needed.

Along with instruction in English, these young Italians are given a picture of the working of democracy so that Fascist propaganda may be counteracted. The United States Government wishes to send these young men back to Europe as leaders in the rehabilitation of Italy, as workers who will spread good will for America among the conquered countries.

Before entering one of the classes in English, an entrant takes a pretest which has been set up by the teachers. Then the entrant is put into one of the seven groups best suited to his ability. Since the men vary in attainment from practically no knowledge of their own language to graduation from one or more European universities, the range of difference is great.

Only one of the seven teachers speaks Italian. Naturally he has charge of the most advanced group. All teachers have interpreters, chosen from the student-personnel. Officers and enlisted men study together democratically in groups of about thirty-five.

The Influence of Objective Measurement

One administrator makes this statement about the use of standard tests: "Our greatest advance has been in the development of a new point of view—in the realization that since differences exist we must do something about them.... The influence of objective measurement of ability and achievement is apparent everywhere. It has given us the basis for organization of new kinds of classes, for refinement in classification, for continuous readjustment of the school program—the beginning of our efforts to adapt the school to the variety of human abilities."

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This year's program has been a success according to both the students and the teachers. For example, one of the instructors said, "I have never met such courteous, intelligent young men."

If people who are sunk in the bog of racial and national prejudice could only see the happy coöperation exhibited between those in charge of this program and those who are the students, they would realize that a common understanding between people of different countries can be reached, that Europe can be educated along democratic lines now that peace has been declared.—GILBERT COLLYER, *president, Lassen Junior College.*

Stanford Announces New Scholarship

TO give an outstanding student a special opportunity to begin his college education, Stanford University will hold a competitive three-hour examination sometime during April, 1946. It is the intention to grant one one-year scholarship of $500, although the right is reserved not to award any if the achievement of no candidate meets the standards deemed proper for this scholarship. The examination will be confined to mathematics, but the recipient will be completely free in the choice of his major subject when he enrolls at Stanford.

The fields included in the examination will be algebra and plane and solid geometry as ordinarily treated in good standard college-preparatory courses. The problems will be comparatively few in number and will not be routine—they will be designed to test the student's mathematical ability, imagination, and understanding.

In order that most students will not have far to travel, the examination will be held simultaneously at several high schools throughout the state. The exact time and places of the examination will be announced soon in a letter to each high school in California.

Teachers of mathematics,

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Vol. 20 NOVEMBER, 1945 No. 7

Next Month

TITLE of next month's symposium is "Common Problems of the State Colleges and High Schools." The following statement by President Frank W. Thomas of the Fresno State College, who has organized the symposium, explains its purpose:

"The recent action of the State Legislature, giving power to the State Board of Education to authorize one or more of the state colleges to establish a fifth year of study and to prepare for the General Secondary Credential, is a development that may affect secondary education in California in a significant way. Although the relationships between the state colleges and the secondary schools have been consistently intimate, the evolving programs and philosophy of the state colleges have not been as clearly understood as might be desirable. Accordingly, this issue of the JOURNAL deals with those features of the state colleges which most closely relate them to our secondary schools and which no doubt will be reflected in their expanded programs leading to the General Secondary Credential."

Dr. Thomas himself writes an article describing the distinctive character of the state colleges. President Walter R. Hepner of the San Diego State College writes of the "common denominator and common tasks of California's grass-root institutions, the high schools and the state colleges." Forrest G. Murdock, formerly president of the California Association of Secondary School Principals, and now district superintendent at Inglewood, and Frank B. Lindsay, chief of the Bureau of Secondary Education, State Department of Education, discuss the problem from the point of view of the secondary schools.

Other articles to appear in the December issue include a discussion of the place of methods in adult education, written by Ernest Lundeen, principal of Vallejo Evening High School, and a report on the teaching of government through class activity in the Technical High School, Oakland, written by Ferdinand Diel of that school. S. S. Sutherland, supervisor of agricultural teacher training, University of California and the State Bureau of Agricultural Education, writes of criteria for the establishment of departments of vocational agriculture.

Fortuna Again Has 100 Per Cent Membership

AGAIN this year, as has been the case for nearly ten years, every member of the Fortuna Union High School faculty has joined the California Society of Secondary Education and thus subscribed to the CALIFORNIA JOURNAL OF SECONDARY EDUCATION. Several administrators and instructors in the school always take the $5-corporate membership, and, in addition, the school

itself is an institutional member of the Society.

Principal George J. Badura is a member of the Society's Board of Trustees.

The problems of converting secondary education from a war-time to a postwar basis are readily comparable to the problems of industry. Both education and industry were converted to war-time demands with unsurpassed effectiveness. Both drew in new people to meet the problems of depleted staffs, with resultant lowering of standards in some cases. We all know of the achievements of industry, but the secondary schools have been unduly modest as to the results of their efforts—it was the schools which educated six million workers for war-time industry; the secondary schools gave millions of boys their preinduction training; and teachers drawn from the secondary schools developed many of the Service training aids. There is no reason to believe that the schools cannot be equally as effective as industry in reconversion from a war-time to a peace-time basis.

In this reconversion the mathematics teachers are confronted with problems that have been anticipated. Two important reports on secondary mathematics have become available within the last six months, one from a state-wide and one from a national point of view; they are discussed in the articles by Bacon and by Eagle and Palmer that follow. In several important respects these reports take a new and valuable point of view. In the first place, the total program of mathematics from Grades 1 to 14 is considered as a unit. If it is to be so regarded, teachers and administrators at all levels are required to understand the plans and objectives at all other levels. Secondly, from the point of view of continuity, the reports consider not only the needs of college preparatory students but also those of the pupils who are going into fields other than professional. For the needs of both groups to be met, there is needed a coördinated leadership in the planning of the curriculum that will take a more comprehensive view than has been done in the past. To explore the problems growing out of this over-all point of view Lorraine Sherer and Harriette Burr have been asked to summarize, in the pages that follow, the program of the elementary school and of mathematics for general education.

The committees presenting the reports just mentioned have emphasized that they are to be considered only as general guides by those who are to continue the reconstruction of the mathematics program. That important work remains to be done is emphasized by Siemens, Freeman, and Schorling in their contributions to the current symposium.

The current yearbook of the National Council of Teachers of Mathematics is concerned with multi-sensory aids ("Multi-Sensory Aids in Teaching Mathematics," Eighteenth Yearbook, Bureau of Publications, Teachers College, New York, 1945). Professor Schorling, who served as consultant in the Training Course Section of the Navy, presents some important considerations in his article that have been overlooked in most programs for use of visual aids.

The educational program in any field can be developed only when evidence is available regarding the present and imminent demands of society, the characteristics and needs of the pupils concerned, the potential contributions which the field of learning may make, and what we know from the psychology of learning and child development as to the attainability of objectives and desirable forms of experience. The present symposium calls attention to the importance of these considerations and to the need for action. It follows that the next step is one to be taken under coöperative leadership of groups competent to deal with all these factors. Whether the original stimulus comes from the State Department of Education, the mathematics teachers as represented by the California Mathematics Council, the state curriculum or education committees, or others, certainly all must work jointly and intelligently if any solid progress is to be made.—LUCIEN B. KINNEY, Associate Editor.

Re the California Report On Mathematics

By HAROLD M. BACON

This article by Dr. Bacon, associate professor of mathematics, Stanford University, while not giving a comprehensive summary of the Report of the California Subcommittee on Mathematics, nevertheless does describe how the report was formulated, what were its purposes, and the nature of its major recommendations. Copies of the complete report can be secured from Dr. Hiram W. Edwards, director of Relations with Schools, University of California, and secretary of the California Committee for the Study of Education, which sponsored the study.

The report itself has been the center of controversy since it first appeared. In presenting this article by Professor Bacon, those who planned this symposium do not necessarily endorse the Subcommittee recommendations; but, feeling that progress in the improvement of mathematics teaching can come only as a result of thorough acquaintance with all that has been written on the subject, they attempt to bring "Journal" readers up to date with this latest development in the field.

THE Subcommittee on Mathematics regards the customary division of the subject matter of mathematics instruction as sound; that is to say, arithmetic is essentially the work of the elementary school; algebra, geometry, and trigonometry, however, arranged, belong in the secondary school; while analytic geometry, calculus, and more advanced subjects belong in the college.

Such a division is not rigid; certain overlapping is advantageous and necessary in some cases. Furthermore, the desirability of continued review of and constant practice with basic processes is recommended. The good curriculum and the good teacher provide for the tying together of all the mathematics studied. But this does not imply that mathematics should not be presented with emphasis on the different topics distributed between elementary, secondary, and collegiate schools as mentioned.

The unsatisfactory performance in mathematics and the neglect of mathematics by large numbers of pupils have, in recent years, come more and more into unfavorable notice. The Subcommittee does not regard this fact as indicating the need for drastic change either in mathematics teaching or in the mathematics curriculum. Some far-reaching modifications, however, are needed, especially to provide better for that large majority of students not expecting to go on to college.

Good teaching with good results is being done where well prepared and interested teachers are able to do their work under reasonably favorable conditions. The teacher is more important than the plan of instruction laid down in any curriculum. But the teacher deserves the best curriculum plan it is possible to construct and the best conditions under which to carry on his work that can be realized. Among other things, the energy of the teacher should be devoted to teaching and not be dissipated on extraneous extracurricular activities imposed by a community or administration.

The importance of a thorough grounding in arithmetic and of some experience with more advanced subjects for prospective elementary teachers is

urgent. The elementary school teacher plays a vital rôle in developing the pupil's attitude toward mathematics and should be well prepared.

To be judged successful in his study of arithmetic or of any other mathematics, the student should be able to demonstrate ability to use his knowledge in the solution of problems not simply of a manipulative or routine character. Each student should be provided with the opportunity, and encouraged to try, to master as much mathematics as his ability permits.

This implies providing not only substantial work in algebra, geometry, trigonometry, and their applications for able high school students, but also work in mathematics adapted in various ways to the abilities and interests of those pupils not endowed with much aptitude for mathematics.

This means having suitable courses available for large numbers of students throughout the four years of high school, with emphasis on value to the student.

IT is the purpose of the report to suggest certain ways in which desired results might be obtained.

Perhaps the most obvious fact about the high school population is its heterogeneity in ability, background, interests, and intentions regarding further education. One finds students who plan to go to college and those who do not, students who have well-defined vocational and cultural interests and those who have none, students with ability and those with none, as well as students with sundry combinations of these attributes.

In its consideration of mathematics in the secondary school, the Subcommittee makes suggestions for programs for five different categories of students, as follows: (1) college preparatory students who profess an interest in science, mathematics, and engineering; (2) college preparatory students who express interest in nonscientific subjects; (3) nonpreparatory students who express interest in industrial work and trades requiring a relatively extensive training in mathematics, and who have reasonably good mathematical aptitude; (4) nonpreparatory students with general or undefined interests, but who possess reasonable mathematical aptitude; and (5) nonpreparatory students with low mathematical aptitude, regardless of expressed interests.

Two facts should be noted in regard to this classification. There will be students with low mathematical aptitude who expect to attend college; they are included in Groups 1 and 2. Group 5 includes all "slow" students regardless of expressed interests; it hardly seems possible to make a further division on the basis of future intentions or occupational interest of these pupils.

In all of the programs considered in the report, the importance of continued review and of attention to previously acquired skill and knowledge as well as need for the study of interrelations among various topics is emphasized. At the same time the Subcommittee is well aware of the fact that not all high schools—perhaps, indeed, only relatively few—are in a position to provide as elaborate an offering as would be represented by the entire program visualized in the report. But what would be very useful in one school might be less so in another, and much flexibility within the limits of a sound program is possible.

IT is also the purpose of the report to emphasize the responsibility of the school system to see that every pupil acquires a working knowledge at least of elementary arithmetic. This is primarily the duty of the elementary school, but it is also the duty of the high school

to supplement the efforts of the elementary school to whatever extent may be necessary. It may be that, in certain cases, especially with students having very little aptitude, the high school must provide work in elementary arithmetic to continue for an extended period of time. There are almost no pupils who cannot learn the fundamentals of arithmetic if given enough time and sympathetic and competent instruction.

For the majority of students the high school provides the final period of formal education, and it should make sure that its graduates can use elementary arithmetic. Many high schools do so. But that some remain which do not, or whose efforts are insufficient, seems evident from the fact that some college officers can consider seriously the necessity for giving qualifying tests covering this subject as well as elementary algebra and geometry.

If our schools cannot insure at least some competence in basic arithmetic by all but the most subnormal pupils as one of the minimum accomplishments of literate citizens, the community surely has grounds for regarding them as a bankrupt enterprise.

IT is also the purpose of the report to point out the importance and necessity of our schools providing a sound training in mathematics for those who can profit by it, and this profit must not be measured by utilitarian standards alone. Those whose mathematical interests are vocational and utilitarian must be served, but also let provision be made for the able student who enjoys the power of the mathematical method, the beauty of the abstract, and the intellectual satisfaction of achieving real understanding.

In our quite proper anxiety to plan programs for the benefit of weaker students, we are likely to neglect the even more urgent needs of our potentially strongest students since they can surpass the modest standards set for the average without the need of any special attention. If we are to conserve and develop to the full the best of our human resources, the school must help to discover and develop the talents latent in our school population. To fail to do so is to fail society.

The unusually capable student, whatever the subject in which his talent manifests itself, should be given the opportunity to push his study and investigation beyond the realm of the average. This requires well-trained and discerning teachers, and one purpose of the report is to call attention to the necessity of adding to their ranks.

TO repeat, the report makes various suggestions regarding mathematics curricula and discusses other problems of mathematics teaching.

It carries with it constantly the conviction that to make any plan or curriculum, however skillfully and thoughtfully contrived, succeed our schools must have trained and inspiring teachers. It pays tribute to those many teachers who have played, and who are now playing, such a valuable part in the mathematical education of our youth. We need more such teachers; we must recruit them from among our promising young people; we must see that they are given an adequate training; we must see that they are better compensated. They are the foundation of our educational system, and their position should be an honored one.

Throughout its report the Subcommittee takes the position that its proper function is to make suggestions of somewhat general character and not to propose detailed outlines of courses or detailed curricula. Although certain principles are of wide application and might be specified by central authority, variations are necessary to meet local

conditions. Such specifications, however, are within the field of the state school authorities, and it is the intention of the Subcommittee simply to submit suggestions which it believes may prove helpful.

The Subcommittee believes that the California Committee for the Study of Education to which the report is addressed will wish to make the report available not only to school administrators and school departments, but also very widely to teachers with whom, necessarily, the success of any program lies and from whom should come fruitful suggestions and practical and constructive criticism—as well as to the public which, after all, is intimately concerned with the product of our schools.

THE report was prepared by a second Subcommittee on Mathematics which was authorized by the California Committee for the Study of Education in October, 1943. A first Subcommittee had been appointed in August, 1942, to investigate problems of mathematical education in California, and it prepared and submitted a report to the California Committee in May, 1943.

The second Subcommittee was to continue the study of problems of mathematical education, the problems of articulation between the mathematics programs of the various units of the State's educational system arising in both public and private schools and colleges, and also the problems of recruiting and training of teachers.

The present Subcommittee assembled a large amount of material, including many outlines of courses in mathematics of all types, articles in educational and other periodicals, statistical reports, and reports of school departments and special committees and conferences, both in California and elsewhere. It also sent a letter to the principal of each junior and senior high school in California, requesting observations on the mathematics curriculum in effect in his school and any suggestions which he might be able to make. Responses were representative and very helpful.

All materials were studied, and, in addition, the members of the Subcommittee talked individually with many people connected with business, industry, the Armed Forces, agriculture, and education. The opinions of all groups of educators were secured. The Subcommittee also received benefit from suggestions and comments from a group of consultants representing a wide variety of educational interests and groups located in all parts of the State.

The Subcommittee report, covering some forty pages of single-spaced mimeographing, was submitted to the California Committee in March, 1945.

The Subcommittee members follow: H. M. Bacon, associate professor of mathematics, Stanford University, chairman; A. C. Hearn, principal, Coronado High School, Coronado; Sara M. Jordan, Department of Mathematics, Francis Polytechnic High School, Los Angeles; Sophia Levy McDonald, associate professor of mathematics, University of California, Berkeley; M. E. Mushlitz, assistant superintendent of schools, County of Ventura, Ventura. All members of the Subcommittee, except the last one named, approved and signed the report as submitted.

Audio-Visual Instructional Services Set Up by NEA

The new Audio-Visual Instructional Services Division added by the National Education Association during the school year 1945-46—under the direction of Vernon G. Dameron, formerly with the Army Air Forces at Chanute Field, Illinois—expects to get as much surplus equipment as can be obtained for schools needing audio-visual supplies and materials.

Reactions to the National Council Report

By EDWIN EAGLE
GEORGE W. PALMER

At the mathematics section of the Education Institute last July at Stanford University, Mr. Eagle and Mr. Palmer summarized and led the discussion on the second report of the Commission on Postwar Plans of the National Council of Teachers of Mathematics. The discussion appeared to be of such general value that they were asked to prepare for publication in the "Journal" a statement summarizing the reactions.

Mr. Eagle has had experience in teaching mathematics in high schools in Montana and California. In 1942-43 he taught mathematics in the junior college at Taft, and in 1943-44 at Oregon State College. At the present time he is working on a graduate degree in Education at Stanford University. Mr. Palmer was a teacher in the Excelsior University High School, teaching mathematics at the time when he left education to join the army. For three years in the Army he was connected with educational work, part of the time as an executive in an Army school and part of the time as a commanding officer of an American Military Government Team. At the present time he is a graduate student in Education at Stanford University.

THE Commission on Postwar Plans appointed by the National Council of Teachers of Mathematics has published recently its second report.[1] One session of the mathematics section of the Education Institutes held at Stanford School of Education in July was devoted to a study of this report. It is the purpose here to summarize some of the reactions expressed at that meeting.

The Commission, under the chairmanship of Raleigh Schorling, spent a year in preparing what is, doubtless, one of the most important documents to be issued by the Council for many years. For that reason its report deserves careful study at a time when the mathematics programs in all schools are being carefully worked over.

Discussion at the Stanford Institute meetings indicated that a number of important recommendations of the report may be accepted as clearly constituting an advance over what is now current practice in many of our schools. On certain aspects of the report, however, the group desired a sharper definition of issues and recommendations. In addition, the discussion developed a few significant problems not touched on by the Commission, which appear worthy of consideration. These three aspects of the Institute's reaction will be considered in the order mentioned.

PERTINENT and timely is the emphasis of the report on the importance of a carefully planned and closely correlated mathematics program for the entire span of elementary and secondary education from Grade 1 through 14. The general purpose of such a program is summarized in Thesis 1 of the report: "The school should guarantee functional competence in mathematics to all who can possibly achieve it."

In Grades 1 to 6, arithmetic, far from being merely a tool subject, has both a mathematical aim and a social aim. For Grades 7 and 8 a single uni-

[1] "Second Report of the Commission on Post-War Plans," *The Mathematics Teacher*, 38: 195–221, May, 1945. The quotations that follow are from this reference.

fied program is recommended which is "to provide an adequate, organic continuation of the work of Grades 1 to 6, ... provide a substantial beginning in achieving functional competence, ... and provide a dependable foundation for subsequent courses in mathematics."

A dual responsibility is designated for the high school: (1) To provide sound mathematical training for our future leaders of science, mathematics, and other learned fields; and (2) to insure (for all) mathematical competence for the ordinary affairs of life. . . ."

For the junior college three types of courses are recommended: (1) A general, flexible, functional course for "those students who desire some knowledge of mathematics as a part of their cultural background; (2) a one-year prevocational course in mathematics adapted to local conditions; (3) adequate college preparatory courses for students who plan to go into engineering, science, or pure mathematics.

This emphasis on an integrated program indicates concern over the lack of an over-all plan and a poor correlation between successive grades which is characteristic of the past. As pointed out in the report, "It is sensible because of the essential continuity of mathematical instruction to plan the improvements in any one grade in terms of the total program." In stressing the importance of a carefully planned program, the Commission doubtless would agree to the importance of periodic measurement of pupil progress and diagnosis of student difficulties as a basis for learning activities. We must not lose sight of the fact that the existence of the plan on paper does not guarantee the corresponding continuity of progress of the individual pupil.

Another recommendation that deserves to be underlined refers to the importance of giving "more emphasis and much more careful attention to the development of meanings." The Commission asserts that "The purpose of arithmetic cannot be fully attained unless children understand what they learn and know when and how to use it." From this standpoint mere computational skill established on a knee-jerk, mechanical manipulation basis is of relatively little value. The report has some excellent suggestions for developing a program to achieve these desired fundamental understandings.

One suggested means of providing significant concrete experiences rich in mathematical content is the use of multisensory aids. The Commission urges teachers to become acquainted with recent developments, particularly in the production, selection, and use of slide films of the types extensively and successfully used in training programs of the Armed Forces. The Eighteenth Yearbook of the National Council of Mathematics Teachers[2] is devoted to the use of multisensory aids.

A second suggestion is that "The work of each year should be organized into a few large units built around key concepts and fundamental principles." The essential unity and continuity of mathematics is to be developed more in terms of general ideas than in terms of details. To this end the "natural interrelations between algebra, geometry, and trigonometry should be emphasized."

Also heartily endorsed by the Stanford Institute was the broad concept of evaluation presented in the report. The Stanford group felt that a revitalizing effect on the entire mathematics program would result from an evaluation which goes beyond the measurement of skill in computation and "takes account of mathematical understandings, mathe-

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[2] *Multisensory Aids in the Teaching of Mathematics*, Eighteenth Yearbook of the National Council of Teachers of Mathematics, Bureau of Publications, Teachers College, Columbia University, New York, 1945.

matical judgments, the ability to estimate and approximate, habits of use, and the like." While the report, at this point, is suggestive rather than definitive, it clearly indicates an important area in which work needs to be done.

The Institute group also underlined the Commission's comments on the importance of an improved program of teacher education. The report specifically suggested minimum standards as follows: for teachers in Grades 1 to 6, the achievement of tenth-grade norms in computation and problem solving on some reliable standard test; for teachers of Grades 7 and 8, competence over a wider range of subject matter to include elements of algebra, geometry, and trigonometry; for high school mathematics teachers, a college minor in mathematics.

A RATHER large part of the Commission's report depends for its meaning on an interpretation of the term "functional competence." The Institute group felt the need for a clearer definition of this term than that presented in the report.

In outlining the prime objective, the guaranteeing of "functional competence in mathematics to all who can possibly achieve it," the Commission set up twenty-eight items in a check-list. Sixteen of these apply purely to mathematics without regard to any application; five of them may be said to deal somewhat indirectly with applications; five more of them deal quite directly with applications to life situations; and two of them refer to the possession of information. Thus, for the most part, "functional competence" is being defined narrowly in terms of purely mathematical abilities, perhaps we might say in terms of an intermediate step instead of in terms of the desired end-results.

If the aim of mathematics is to develop an individual who can do quantitative thinking effectively; who can communicate quantitative ideas; who can solve quantitative problems as a student, and as a worker, consumer, and citizen; and who has an appreciation of the mathematical aspects of the world and of our technical civilization—if this is the case, then the definition of "functional competence" should be in those terms. The person who can manipulate mathematical forms but who lacks understanding of mathematics is in somewhat the same position as a near-sighted, color-blind, astigmatic person in an art gallery; he may get along after a fashion, but inefficiently and with difficulty, and certainly he will miss most of the thrills and will make little contribution.

A careful study of the report and some familiarity with the work of members of the Commission would lead one to believe that they had in mind a broader concept of "functional competence" than was explicitly stated. We find, for example: "If arithmetic does not contribute to more effective living, it has no place in the elementary curriculum." The check list, however, comprises the only definition of "functional competence," and the report as a whole leaves one with the impression that the Commission is more concerned with the question: "How can we make pupils do better in mathematics?" than with "How can we make the pupil more effective through mathematics?"

The Institute group felt that the Commission's sweeping recommendation of a double track in mathematics at the ninth grade, "algebra for some and general mathematics for the rest," could not be accepted without further study. The Commission report was somewhat inconsistent in that it pointed to the great range in IQ as the basis for the need of a double track but recommended segregation primarily on the basis of differing student goals.

Those at the Institute clearly recognized the need of providing adequate and challenging courses for the superior students, perhaps our most neglected group; and at the same time providing an equally adequate and challenging program for the average and the less gifted pupils. It was pointed out that the nature and the extent of the problem, and therefore the solution, might vary with the type of school organization (*e. g.*, 8-4; 6-3-3, and so on), and also with the differing population characteristics and employment opportunities. In many schools it might be best to have all ninth grade students together in a general mathematics course.

The Institute group pointed out that the first-year algebra favored by the Commission (*e. g.*, including practical applications, reducing the manipulation of complicated symbols, and so on) might be incorporated in such a general mathematics course. Under present conditions, much review and reteaching of fundamentals of first-year algebra usually is necessary in intermediate algebra. Possibly a thorough course in general mathematics would be a satisfactory prerequisite.

Certainly all of the material of the modern general mathematics course is as personally significant to the college preparatory students as to others. In view of all the facts brought out in the discussion, it is clear that the mathematics program at the ninth-grade level still remains as an important problem.

THE Institute group recognized that the mathematics program presents many crucial present-day problems which the Commission could not be expected to deal with in the limited space at its disposal. One example is the necessity of full coöperation with the administration and guidance work within the school if the mathematics program, however excellent, is to function. The administration of an adequate mathematics program designed for all pupils is a problem which is the direct concern of those directing the guidance program. They must bring together all possible information about each student, to the end that he may select the parts of the program he requires.

It should never be forgotten that effective learning takes place only if each individual pupil makes the correct choice in planning for his needs. It is this guidance function of education which has been so sadly neglected in the teaching of mathematics in the past.

A second point which the members of the Institute considered as neglected in the report had to do with taking account of the way in which pupils learn mathematics. None of the twenty-two theses of the report which outline the recommended program makes reference to pupil interest or motivation. Only indirectly, through its reference to improved teaching techniques and to improvement in education of teachers, does the report include this important aspect. The emphasis is rather on the selection and organization of content, almost to the exclusion of any consideration of the nature of the pupil and his effective learning.

IT has been attempted within the brief scope of this article to summarize some reactions to the major premises of the Second Report of the Commission on Postwar Plans for Mathematics. Most of the critical reactions have dealt with the need for further clarification rather than differences of opinions. Clearly the Commission cannot be criticized for not completely analyzing every aspect of postwar mathematics. While the Commission has borne the major burden of the preliminary work, it is the responsibility of all who are interested in mathematics to help chart our future policies.

Some Problems in Secondary Mathematics

By CORNELIUS H. SIEMENS

The summary of fallacies characterizing the popular attitude towards the teaching of mathematics with which Dr. Siemens begins his article gives him a chance to explore in an interesting fashion certain unsolved problems in the field of secondary school mathematics.

Dr. Siemens is assistant professor of education at the University of California, Berkeley. He is particularly well-known in the field of secondary school aeronautics, having been an educational consultant for the Civil Aeronautics Administration for several years and being the author of the "Aeronautics Workbook." At present he is supervising the distribution of surplus aircraft materials for five West Coast naval air stations. Since January 1, 1945, Professor Siemens has served as chairman of the Department of Institutes, University Extension—a new unit of the University which aims to fill the need for short and intensive educational programs on the college and postcollege level, particularly for professional groups.

SQUARING the circle and trisecting the angle are relatively easy projects, compared with the problems confronting those responsible for planning programs of mathematics in the secondary schools. The teaching of high school mathematics today poses more questions and presents more difficult situations than at any time since mathematics was included in the secondary curriculum.

Almost all of the reports or studies suggesting changes in the field of mathematics have dealt with individual courses, or they have made general recommendations concerning only one or two aspects of the mathematics curriculum. Most of the specific recommendations have been formulated in terms of the college preparatory program and from the point of view of the subject matter of mathematics, usually unrelated to the rest of the school program. Furthermore, very few of the recommendations and suggestions for change have been predicated upon scientific studies or even representative data. The conclusions drawn are, in the main, the result of committee deliberations, authoritative statements, casual observations, and limited and, frequently, fragmentary test results.

ONE of the most serious infractions of the scientific procedure for solving problems has been the unwarranted and falacious assumptions upon which both unofficial and official recommendations for reorganizing the mathematics curriculum have been based. Some of the more questionable assumptions that are to be found in various reports are enumerated below:

. . . That understanding the subject matter of mathematics is a worth-while end in itself.

. . . That mathematical content exists chiefly, if not entirely, in textbooks.

. . . That the four-year college preparatory sequence of logically arranged topics leaves little to be desired.

. . . That a satisfactory program for the noncollege student can be made up from the less difficult subject matter and that such program can be organized and taught in the same way as any other mathematics course.

. . . That through general mathematics courses "mathematical competence for the ordinary affairs of life" is insured for the major fraction of the high school population.

. . . That satisfactory solutions for the mathematics curriculum can be found by administratively rearranging courses, subject matter, prerequisites, and guidance procedures.

. . . That mathematics should have a fundamental place in the curriculum by reason of its values as a mental discipline alone.

. . . That the subject matter of mathematics is of great value *per se*.

. . . That the interests and needs of the students do not necessarily play an important part in the planning of mathematics courses or in the value received by the students.

. . . That the subject of mathematics is a separate entity in the school curriculum and that the teaching of mathematics should comprise a separate department.

. . . That success in the teaching of mathematics is guaranteed when the teacher is a specialist in the subject and is interested in her students.

. . . That arithmetic, when given on the secondary level, should be taught, in the main, in the way it was presented on the elementary level.

. . . That arithmetic learned on the elementary level and preserved in memory will function practically for the youth in high school or for the adult; in other words, that arithmetical literacy is the same as manipulative competency.

. . . That the general educational needs in mathematics for noncollege students comprise a common core of subject matter for all students.

. . . That in adult life there is a widespread and constant use of the subject matter of mathematics beyond arithmetic.

. . . That a study of mathematics is of itself, and automatically, good training in developing thinking, and that such training will transfer to many other subject matter areas.

Space does not permit a detailed discussion and elaboration of the aforementioned assumptions. The point to be made here is that many of these are being used as arguments, reasons, and basic premises for holding on to what we have or for making changes. It is not difficult, however, to show that some of them are fallacious on the basis of research studies, that others are seriously to be questioned because of contradictory findings, and that still others are far from being axiomatic. Furthermore, not one of the assumptions listed above has been proved to be true, and, therefore, none of them should be used as the basis for planning the mathematics program. It is the purpose here to outline some of the needs which are calling for attention and early fulfillment.

WHAT is most needed, of course, is a series of thoroughgoing investigations encompassing all the aspects of mathematics in the secondary curriculum. Such studies must begin with, and constantly be keyed to, the acceptable general objectives of the secondary school. It is time that we stopped analyzing, studying, and justifying only one section of the curriculum at a time with complete disregard for the interrelationships among the various portions or the relationship between any one portion and the whole school program.

We can justify only such mathematics as contributes to the fulfillment of the general objectives agreed upon and then only for those students for whom it actually fulfills the given objectives. This means that every topic, every problem, and every class activity should be analyzed in terms of its direct contribution

to the specific objectives of the course and, in turn, to the general objectives of the school.

Another job that needs to be done is to analyze the offerings in mathematics in terms of the actual, immediate, and foreseeable needs of *all* students. This implies the difficult and continuous job of determining the present and future needs of all students. But until and unless we can make a serious attempt to determine what it is we are trying to do for the students we should not be deluded into believing that the needs of even one-half of our pupils are being met adequately.

A reappraisal of values accruing to the student from a study of mathematics is closely related to a study of his needs. The time is past when the acclaimed values of mental training, transfer, and "fundamental education" are to be accepted as axiomatic. Real values which are evident or can be made evident to the student should be the criteria for selecting subject matter and determining required content.

A program based upon needs and real values will perforce be somewhat different in every school; we will find it necessary to change the course offerings and the course content as frequently as a change in needs and values becomes evident. Furthermore, to be effective, every teacher and every student must be included in an analysis of needs, interests, values, and abilities. It is not enough that the administration determine the program on the basis of a few statistics, teacher opinions, and the choices that students have made in a hasty preënrollment survey.

THERE is also a great need to help the teacher of mathematics improve his instructional techniques, his selection of materials, and the planning of the work of the course on the basis of what we now know about the psychology of teaching and learning, the nature of the student, and the use of mathematics in college, in industry, in business, and in life generally. In other words, there is needed a translation of the scientifically determined generalizations into practical implications for the teacher of mathematics. We cannot expect that the individual teacher has the time or the background to interpret for himself what changes he should make in his teaching because of the new findings in the science of education.

For example, Hull's statement concerning a theory of learning is as follows: "If the central afferent receptor discharge (Sc) of a stimulus element (Sc) of a stimulus compound is active in the central nervous system at the time that a reaction (ru) is evoked, and if at about this time there occurs a 'reinforcing state of affairs,' there will result from this conjunction of events an increment to a habit (sHr)."[1] Another example is a statement by Leonard concerning learning, which reads: "The resolution of a satisfactory compromise with inconsistencies becomes the normal life, and each new experience becomes a problem to be solved. This problem projects itself backwards, forwards, and into the immediate present all at the same time, as the need for resolution makes demand on everything the individual can bring to bear upon the disturbance."[2]

Assuming the classroom teacher's competency to read these statements with understanding, there is serious doubt whether he would be able immediately to make a direct application in his everyday teaching program. Our psychologists, theorists, and curriculum ex-

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1 "Conditioning: Outline of a Systematic Theory of Learning," by Clark L. Hull. *Forty-First Yearbook* of the National Society for the Study of Education, Part II. Public School Publishing Co., Bloomington, Illinois, 1942; p. 65.

2 *An Evaluation of Modern Education*, by J. Paul Leonard and Alvin C. Eurich, D. Appleton Century Company, Inc., 1942; pp. 6–7.

perts owe it to the teaching profession to reduce their pronouncements to the simplest terms and also to translate their findings into such form that they may be readily implemented by the ordinary classroom teacher.

In this same problem area there is need for greater attention to be given in committee reports to the improvement of mathematics teaching through better method, better teaching aids, and greater application of the principles of learning. The reports spend an undue portion of their space on administrative overhauling or on a formal justification of the program which is ofttimes of very little concern or help to the classroom teacher. What is needed is a thorough analysis of the teaching of mathematics resulting in helpful suggestions and instructional aids for the teachers, stated in language that is meaningful and direct.

MATHEMATICS must be vitalized by use of sensory aids to learning, including more and better film strips, films, models, charts, field trips, photographs, texts, and workbooks. Teachers should make their needs and desires known while at the same time making the most effective use of available aids and improvising others.

Texts are very much in need of improvement; a new cover, a few pictures of airplanes, and a few problems mentioning the national debt do not constitute a satisfactory and helpful revision. A good text should include hundreds of true-to-life applied problems, better diagrams, more meaningful pictures, cartoons and charts, statements of objectives and outcomes which are convincing to the student, and content selected not so much for its time-honored position in mathematics subject matter as for value in helping the student to learn the concepts, knowledge, appreciations, and understandings which make up the objectives of the course.

A recognized fundamental weakness in the mathematics programs lies in the preparation of teachers. It is becoming more evident that, in view of the fact that 80 per cent of our youth are not college bound, all of our mathematics teachers are trained as if they were going to teach only college preparatory courses. Their training is specialized at the expense of a broader education in allied fields and a lack of experience with the practical applications of mathematics.

There is needed a scientific study to determine a training program which will include the minimum essentials for successful mathematics teaching on the secondary level. It is becoming obvious that a mathematics teacher whose preparation consists solely of college-level courses of mathematics is not necessarily trained to do a successful job in the high school. Many teachers have learned how to teach mathematics (and relearned much of the subject matter) only after they were on the job and by virtue of helpful supervision and sympathetic, experienced fellow teachers.

A FINAL note to be emphasized is that the improvement of the mathematics programs in the secondary schools depends on whether directors of teacher training institutions, school administrators, supervisors, and teachers become aware of the real issues and problems, studying and analyzing the situation first hand, and then separately and jointly effecting those changes which sound conclusions dictate. In the postwar era now beginning, we must have the courage of our convictions, making bold changes where they are clearly needed, but holding fast to programs of proved success. It is neither a time for slow motion nor for wholesale revolution; it is a time for vigorous study and positive action.

The Manner in Which Pupils Learn Mathematics

By LUCIEN B. KINNEY
FRANK N. FREEMAN

IT is the purpose of this discussion to call attention to certain characteristics of the learning process which are of particular importance not only in the planning of classroom activities but also in the content, organization, and desired outcomes in mathematics. These characteristics appear to be recognized by all of the schools of psychology which are important at the present time—McConnell in a recent symposium[1] found a number of important characteristics which were common to all schools of psychology represented and concluded that, for practical purposes, the similarities were greater than the differences. In view of these agreements, and in view also of the tendency of spokesmen for the various schools to come closer together in diagnosing and interpreting real situations, it appears desirable to set down some fundamental aspects of the learning process and to indicate some implications for practice that can be based on them.

In the discussion that follows, four characteristics of the learning process will be presented and illustrated. They are as follows:

I. Learning is a purposeful and active process.

II. Learning is a reorganization of behavior.

III. Learning is by wholes.

IV. Learning is colored by feelings and emotions.

Let us turn to the first of these to see what it includes and what the implications are for the teacher of mathematics.

[1] *The Psychology of Learning, Forty-first Yearbook*, National Society for the Study of Education, Part II, Public School Publishing Company, Bloomington, Illinois, 1942.

Throughout this symposium there is frequent mention that before progress can be made in the improvement of the teaching of mathematics in our schools one of the first things which must be done is for us to know more about how pupils learn mathematics. To serve this purpose the deans of two university schools of education have prepared the present article.

Dr. Kinney, acting dean of the school of education, Stanford University, is the author of several texts in the mathematics field, the most recent of which, "Senior Mathematics for High Schools," he published this last spring in collaboration with Harl Douglass. He is executive secretary of the California Mathematics Council. Dr. Freeman has been dean of the school of education at the University of California, Berkeley, since 1939, coming there from a professorship at the University of Chicago. He has always interested himself in the psychology of learning, particularly with relation to the tool subjects. His recent article in the May, 1944, "Journal," entitled "Teaching Mathematics for the Million," should be read in connection with the present symposium.

Dean Kinney planned and organized the present symposium.

LEARNING IS PURPOSEFUL AND ACTIVE, RATHER THAN PASSIVE AND RECEPTIVE. Perhaps the most significant shift in the thinking in the field of psychology of learning over the past sixteen years is in the increased importance assigned to motivation and goal seeking in the process of learning. It is recognized that the purposes (or motives, or goals) determine (*a*) the out-

comes of classroom activities, (*b*) the intensity of the experience, (*c*) the aspects of the situation that are attended to, and (*d*) the persistence with which the learning activity is pursued.

Each of a group of pupils pursuing the same activity may, in terms of outcomes, be learning something different, depending on the reason for which he is pursuing the activity. The pupil who is learning to solve equations in order to carry out a project in measuring inaccessible distances by indirect measurement is learning something quite different from the pupil learning to solve equations to avoid staying after school, or one trying to get an A so that he can avoid difficulty with his parents.

It has been interesting to note how the Army, Navy, and industrial programs have moved into line with psychological theory on this point over the past five years. Compare, for example, the insistence of the Army and Navy upon real problem situations in their learning activities, with the point of view expressed by Kadushin,[2]

> Learning goes on best in the degree that the individual sees and feels the significance to his own felt needs of what he does.

Industry, as represented by Kadushin, has discovered this fact through practical experience. Wheeler arrived at the same conclusion through a study of the researches in the field of motivation and the psychology of learning and stated it as follows:

> No transfer will occur unless the material is learned in connection with the field to which transfer is desired. Isolated subjects and ideas do not integrate.[3]

It would be easy to devote this entire discussion to the implications of this one characteristic of the learning process. There is an implication, for example, that mathematical principles and processes should be studied first in the situations in which they have been used or will be used. Geometry, if this implication were followed through to its logical conclusion, would become a study of the shape, size, and position of objects in the physical environment before it becomes an abstract study of logic. The applications of mathematics, rather than an enrichment or "sugar-coating" of an abstract course in mathematical generalities, become the setting which makes it possible to deal with mathematical processes in a genuine problem situation.

In what has just been said, emphasis is placed on the importance of "significance" in the planning of classroom activities. Significance in this sense is the recognition by the pupil of the importance of the activity to himself. It is true that the pupil can be motivated to learn mathematical processes for their own sake because of the rhythm and perfection of the processes themselves. The danger in this latter point of view, however, lies in the possible sterility of the learning unless, as Wheeler puts it, it is integrated with an activity or purpose which is socially or personally significant to the pupil.

Learning Is a Reorganization of Behavior. Learning is a developmental process, rather than one of accumulation. It must develop out of the current status of the individual. It must result, furthermore, from an active rather than a passive experience. To put it in another way, we do not teach a pupil; we merely set the stage for his effective learning.

It follows that an effective classroom procedure must be based on an adequate evaluation which will reveal to teacher and pupil the individual's present level of ability in the process being

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[2] James Kadushin, "Mathematics in Present-Day Industry," *The Mathematics Teacher*, 35: 260–264, October, 1942.

[3] Raymond Holder Wheeler, "The New Psychology of Learning," *The Tenth Yearbook*, National Council of Teachers of Mathematics, Bureau of Publications, Columbia University, New York City, 1935; 233–250.

studied. The wide range of individual differences revealed by any such appraisal in a typical classroom presents a rather appalling picture to the teacher.

It is not unusual, in a study of algebraic fractions, to discover that many pupils cannot deal with fractions in arithmetic. This is not peculiar to any school or to any system. True, it suggests in the long run the need for better understanding between the high school and grades as to the desired outcomes of learning. For the given class, however, it suggests the necessity of preceding the study of algebraic fractions with a study of arithmetic fractions.

The developmental nature of the learning process explains the time element in learning familiar to every mathematics teacher. While it is possible to crowd into an eight-week summer session a whole year's course in algebra, it is found usually that the retention after a few months is much less for the short, intensive period than for the longer period. With the longer period, better spacing of topics provides a cyclical procedure, which is in accord with the developmental concept of learning. Thus formulas may be applied from time to time to continually more complex and mature applications. The review of a process is thought of as its application to a new situation, rather than to a repetition of a preceding situation.

It is an interesting, and perhaps unfortunate fact, that the importance of the time element in learning, and the advantages of cyclical organization, have not suggested to various curriculum committees the possibilities of the European plan of curriculum, which carried the various fields in parallel over several years. Both theoretically and in practice this arrangement offers promise.

Since learning is active rather than passive, it is important that in this spacing the pupil be aware of his increasing facility in the process. Research in the field of motivation reveals that one of the most effective means for motivation devices lies in providing the pupil with knowledge of progress. It is interesting, in view of this fact, that tests designed for self-appraisal are more commonly found in periodicals such as *Reader's Digest* than in textbook or teaching materials.

Perhaps the most serious failure to recognize the developmental nature of learning has been in the field of arithmetic. Despite recommendations that arithmetic should be continued from time to time in the high school, the typical curriculum in college preparatory mathematics does not provide for effective arithmetic experiences beyond the eighth grade. It follows that most adults have understandings in this field only as applied to situations suitable at the most to a 14-year-old pupil. If the developmental nature of learning were recognized, we should, from year to year through the high school, apply arithmetic to continually more mature situations so that the processes and methods would be integrated with adult application. Until this is provided for explicitly in the curriculum, our citizens undoubtedly will continue to manifest arrested development in arithmetic.

LEARNING IS BY WHOLES. The questions which gave rise to the classical experimentation on whole-part learning have been answered almost completely by agreement that the part and the whole are so intimately related that each derives its meaning from the other. In some cases, we must remember, attention is directed more to the whole; and in other cases it is directed more to the part. For example, the human organism is made up of parts or organs. Each organ has a function to perform

in the organism. This function is different from that of other organs, and to this degree the organ is a separate unit. On the other hand, the organ is of no significance apart from the other organs and from the organism as a whole. Furthermore, the functioning of each organ is influenced by the condition of the organism as a whole. It is false to say that either the organism or the organ has meaning apart from the other. For some purposes it is more important to study the behavior of the organism as a whole, and for other purposes it is more important to study the behavior of the organ.

As applied to mathematics, the principles which have been set forth imply that it is desirable sometimes to concentrate upon a general topic or principle so as to get an overview. At other times, it is desirable to concentrate on some narrower case or application or on a principle of narrower scope. In other instances, it is desirable to see a particular process in its relation to other processes and to more general principles. The general principles can be understood, however, only in terms of particular instances or particular applications.

As applied to the earlier stages of the study of arithmetic, this would mean that due attention should be given to the nature of the number system and to such relations as have a variety of applications. For example, the zero combinations should not be treated as separate associations or bonds but as examples of a general principle. On the other hand, it is necessary that the pupil become so familiar with the particular combinations that he does not have to think each one through when he has occasion to use it. The operation should become automatic.

Put in terms of the learning process, this would mean that study should be so planned as to give both understanding and facility. These results will be attained by study and analysis, on the one hand, and by practice on the other. How far understanding is possible will depend upon the circumstances, including capacity and stage of maturity of the pupils and the complexity of the problem. The attainment of understanding doubtless could be much higher than is common.

Somewhat more effort has been expended to develop understanding in the study of arithmetic in the grades than in the study of algebra or geometry, particularly of algebra, in the high school. Undoubtedly the study of relationships is as useful in the high school as it is in the elementary school. At both levels such study promises to provide a new and effective approach to the subject. Experimentation now being done in arithmetic is suggestive of experimentation that might profitably be done in algebra, geometry, and trigonometry.

Implications of this characteristic may be illustrated also in the use of the long-unit assignment, in which the pupil studies for understanding and mastery of a general topic or principle, rather than for daily fragments. Thus, in geometry a unit might be organized on the measurements of angles in relation to circles, with the measurement of the central angle, an inscribed angle, the angle formed by a secant and tangent, or two tangents, and so on, all related back to a general principle.

Such a unit would cover a period of from two to three weeks. It would begin with an overview in which a pupil comes to a general understanding of the whole problem, this to be followed by an "assimilative period" of individual work with supervised study and class discussions dealing with detailed aspects, terminating with a summary in which the various understandings are brought

together in their relations to the whole topic prior to the test on the unit.[4]

A second implication is found in the insistence of many writers in the field of mathematics teaching on understanding the nature of the number system. Thus Wheat says,

> The pupil learns arithmetic only as it builds up meaning for himself, and thus he learns arithmetic only as he builds up meanings that are consistent with the number system.[5]

The interrelations of the number system, as Wheat sees it, provide the whole, and each new process as it is learned is related back to the whole, becomes intelligible because of it, and provides new meaning to the number system itself.

The insistence on the importance of "meaning," which in this sense refers to the development of a broad understanding of the number system and its relationships, has not been applied to any great extent to senior high school mathematics. Undoubtedly it is as useful and as effective at that level as it has been in the grades when applied to arithmetic, where it promises to provide a new and effective approach to the learning of the processes of arithmetic in an intelligent and effective atmosphere. The experimentation now being done in arithmetic is suggestive of experimentation that might be done in algebra, geometry, and trigonometry.

LEARNING IS COLORED BY FEELINGS AND EMOTIONS. This is the "mental hygiene point of view." It raises the question as to *how much* of the pupil a given teacher is responsible for at a given time. A pupil is not only learning algebra; he also is learning to like algebra or to dislike algebra; to like the school or dislike the school; to work as a coöperating member of the group or to work competitively for himself. The attitudes and interests that develop out of classroom activity often are more important than the skills and knowledges which are recognized as a major outcome.

The nature of this attitude toward the activity itself, toward the personalities connected with the situation, and toward the school as a whole is determined in large part by (*a*) the degree to which the pupil recognizes the significance of the activity; (*b*) evidence of his progress toward the goal or failure to achieve; and (*c*) the relation of the activity to his felt needs at the time.

The importance of this aspect of the learning situation may be seen when we consider the large number of adults and pupils in the upper grades whose emotional blocks render them incompetent in the field of mathematics regardless of intellectual level. The little that has been done in tracing back these blocks to their causation reveals that they stem in large part from a failure of the school to recognize the importance of the feeling tone that is attached to any classroom activity. The school board member who recommended that pupil interest should be disregarded and that they should "either learn mathematics or have their teeth kicked down their throats"[6] probably would, if his advice were followed even in spirit, be the source of many more emotional blocks in the adults of the generation to come.

AS was noted at the outset of this discussion, various other characteristics of the learning process might be set up and usefully incorporated into

[4] Procedures in setting up such a unit are described, for example, in *Principles of Unit Instruction*, by A. J. Jones, E. D. Grizell, and W. J. Grinsted, The McGraw-Hill Book Company, Inc., 1939. A summary of nation-wide practices is reported in *Provision for Individual Differences, Marking, and Promotion*, Bulletin No. 13, National Survey of Secondary Education, Washington, D. C., 1932.

[5] Harry G. Wheat, "A Theory of Instruction for the Middle Grades," *The Sixteenth Yearbook*, National Council of Teachers of Mathematics, Bureau of Publications, Columbia University, New York City, 1941; p. 81.

[6] *San Francisco Chronicle*, December 27, 1944.

any planning on the curriculum. The four that have been listed, however, may prove fertile sources of appraisal of the current practices in mathematics, or as bases in the planning of classroom activities or the organization of materials.

1. *The Organization of Activities.* For example, in the development of any process in mathematics to the level of abstraction and understanding, recognition of these four characteristics leads to the following general sequence:

(*a*) The study of real problem situations in which the process is utilized effectively. This might be termed the study of the process at the object level.

(*b*) The study of the process itself. This includes the manipulations involved and the relationship with other processes at the symbolic level. Our common mistake has been to begin at this level, forgetting, as McConnell points out, that "Abstract ideas of number develop out of a great amount of concrete, meaningful experience; mature apprehension of number relationship can be obtained in no other way." [7]

(*c*) The application of the process to numerous other real situations with which, if possible, the pupil is intimately familiar.

Such an organization of content and sequence of classroom procedure takes into account not only the characteristics of the learning process, but also the nature of mathematics itself. As Polya [8] points out, this is characterized by discovery, invention, induction, and deduction.

2. *The Planning of Repetitive Learning.* The present-day psychology does not question the need for practice, but it does question very seriously the effectiveness of drill as it is commonly used. If the characteristics of the learning process are recognized in planning a drill program:

(*a*) The pupil recognizes the purpose and need for the skill,

(*b*) He recognizes his own need for a higher level of skill,

(*c*) He has confidence in his ability to achieve that level,

(*d*) He is capable of self-direction in the practice period,

(*e*) He is provided with knowledge of progress toward the desired skill,

(*f*) The practice programs are suitable in length of periods and spacing of periods to maintain interest,

(*g*) There is provision for integration of the skill to activities in which it is applicable.

3. *The Evaluation Program.* All the characteristics of learning point clearly to the fact that the evaluation of learning in mathematics should be based on the ultimate purposes which the program is to achieve and should be carried out coöperatively by teacher and pupils. The developmental and continuous nature of the learning process suggests that the evaluation itself should be continuous and should be designed to direct the learning on the basis of growth and present status of the pupil. The fact that learning proceeds by wholes, and that details have no meaning independently of the whole, suggests that the evaluation must be complete and comprehensive in terms of all important outcomes. Since, as we have seen, some of these outcomes are in the areas of feelings and emotions, the evaluation should include interests and attitudes as well as skills, knowledge, and understanding.

Obviously, such an evaluation program is dependent upon clearly defined aims, so stated that evidence can be collected and that several competent

[7] T. R. McConnell, "Recent Trends in the Learning Process," *The Sixteenth Yearbook*, National Council of Teachers of Mathematics, Bureau of Publications, Columbia University, New York City; p. 279.

[8] *How To Solve It*, by György Pólya. The Princeton Press, Princeton University, 1945.

observers will agree as to its interpretation. The common practice of stating outcomes in terms of the content of the course or proposed pupil activity is clearly inadequate. Such a statement as "to give practice in addition of fractions" is based on the assumption that such practice will lead to ability to do something. Since this has not been validated (and in fact may be questioned), we must make these implied outcomes explicit in terms of what the pupil should be able to do so that the evaluation program may validate the assumption on which this opinion is based.

The desired outcome, furthermore, should be expressed in operational terms of ability to do something. Mathematical abilities and understandings are valuable only as a means. This is clearly recognized in "The Second Report of the Commission on Post War Plans,"[9] which expresses one purpose as "to insure mathematical competence for the ordinary affairs of life."

Unfortunately, the Commission did not follow through adequately in defining its twenty-eight questions in the check-list.[10] Consider, for example, the question: "Does he have a clear understanding of ratio?" While the desired outcome indicated in this question may be sufficiently definite from a mathematical point of view, it is not sufficiently objective to assure agreement among qualified observers as to what competences are to be insured. Such questions as the following remain:

In what typical situations should this ability be manifested? (It is only in this way that we can define the level of understanding.)

Is the understanding to be for the purpose of thinking about and analyzing situations? of communicating ideas involving ratio? or of operating with ratios in solving problems? And problems of what level of difficulty?

It is quite clear that in order to proceed with an adequate evaluation program in mathematics we need further study of the outcomes that will define the successful product in terms of his increased "mathematical competence for the ordinary affairs of life."

[9] The Commission on Post War Plans, *The Mathematics Teacher*, 38:195, May, 1945.

[10] *Op. cit.* p. 197–198.

United Nations Students Contest Broadens Scope

Enlargement of the annual student contest of the American Association for the United Nations to include private and parochial secondary schools is announced for 1946 by Mrs. Harrison Thomas, education secretary of the Association. The contest, celebrating the Association's twentieth year, deals each year with world organization for peace and will this time have for its theme "The United Nations."

Nearly 1,500 high schools enrolled in last year's competition, with approximately 18,000 students participating. A much larger enrollment is expected for the examination next spring because eligibility, formerly limited to public high schools, has been expanded. A sample study kit, prepared by the Association's Education Department, will be sent out to each participating school. Additional kits for student use will be furnished upon request at a small charge.

Cash prizes, awarded since the war made the usual first prize of a trip to Europe impossible, will be continued in 1946. It is hoped that the overseas tour can be resumed in 1947. Top winner will receive $400, with $100 and $50 being awarded for second and third places.

Mathematics in Elementary Schools

By LORRAINE SHERER

"The work that is being done and the problems that are being encountered in the study of the mathematics curriculum in the elementary school are of importance to secondary school teachers and administrators for a number of reasons. In the first place, as is recognized by both of the current reports reviewed in this symposium, secondary education must be carefully articulated to elementary education in each of the subject fields if either is to be effective. In the second place, common problems are being encountered by the groups at both levels. Consequently the assumptions as well as the activities that are typical of the work being done on the elementary school curriculum in mathematics are of importance to those in the secondary field, and the criticisms and suggestions of the latter should be available to those in the elementary field," writes the author of this article.

Miss Sherer has had extensive experience as a teacher and principal in elementary schools and until recently was the director of curriculum of Los Angeles County Schools. She has been on the summer session staff of U.C.L.A., U.S.C., and Stanford. At the present time she is a graduate student in education at Stanford.

MATHEMATICIANS can render a great service to curriculum improvement in general, and to improvement of the mathematics program in particular, (1) by stating clearly what a good mathematics program aims to do and what it includes, and (2) by describing the conditions under which mathematics is learned. The first of these will be discussed in the present article; the second is discussed elsewhere in the symposium.[1]

Important in the consideration of the first of these services is the recent report of the Commission of War-Time Planning of the National Council of Teachers of Mathematics[2] suggesting improvements in the mathematics program from elementary grades through the last year of the junior college.

In the first place, there is no question that, as the Committee points out, "The program throughout these grades is in need of a thoroughgoing reorganization."

In the second place, an opportunity is presented for the first time for the formulation, on a national scale, of a well-ordered and continuous program of mathematics throughout the entire period of schooling to supersede the present patchy, disconnected, and divergent programs.

And last, and perhaps most important of all, the Committee invites coöperation in the undertaking and is proceeding with its work in a way that should elicit the best thinking and deliberation that can be done in developing a workable plan.

The Commission very properly viewed the program of mathematics in the public school as extending in a unified manner from the primary grades through college. The purposes and problems of each segment of the school system are of concern to all other seg-

1 See "The Manner in Which Pupils Learn Mathematics," by Lucien B. Kinney and Frank N. Freeman.

2 "The Second Report of the Commission on Post-War Plans," *The Mathematics Teacher*, 38:195–221, May, 1945.

ments. It is intended, in this article, to extend and, in some cases, to modify the recommendations of the Commission with regard to the mathematics program in the elementary school, in order that teachers and administrators in the secondary schools may understand more fully the immediate and long-time planning of that program.

A STUDY of the Commission recommendations leads to the conclusion that a program of elementary school mathematics planned in accordance with the Commission's point of view would have these characteristics:

1. It should include in its purposes the broad functions that mathematics plays in the affairs of today.

2. These should be stated in clear-cut objectives, defined in terms of behavior, stating what the pupil is able *to do*.

3. There should be a sequential program, in harmony with the mental and physical development of the children.

4. It should be a broad program, based on the sensitivity of the teacher to the quantitative aspects of the environment. Concepts of quantity, shape, size, and position should be carried through systematically and meaningfully and should be integrated with the environment.

In what follows, the nature of this program will be developed in terms of several principles which seem basic.

THE first may be stated as follows: *The term used to designate the field of learning should be broad enough to describe the field and to indicate the scope it covers.*

What is to be taught in the elementary school, arithmetic or mathematics? Are we to limit the program to computation with numbers, or expand it to include such quantitative concepts as size, shape, and position? The manner in which *mathematics* and *arithmetic* are used interchangeably in many current courses of study, and even in the Commission's report leads to confusion. Arithmetic, which by dictionary definition is "the art of computation with real and positive numbers," is inadequate to develop the kind of mathematical competency essential to living in an airplane and atomic energy age.

Although the current report of the California Subcommittee does not take this viewpoint, the Commission recognizes this in stating that "We must evaluate learning in arithmetic more comprehensively than is common practice. . . . . In arithmetic these outcomes include more than skill in abstract computation and in problem solving. They include mathematical understandings, mathematical judgments. . . . ."[3] This broader idea is expressed in Thesis 1 of the report, calling for "functional competence in mathematics for all who can achieve it."

Functional competence is defined in a check list of essentials, including among others:

1. Does he know the main guides that one should follow in collecting and interpreting data; can he use averages (mean, median, mode); can he make and interpret a graph (bar, line, circle, the graph of a formula, and of a linear equation)?

2. Does he have adequate ideas of point, line, angle, parallel lines, perpendicular lines, triangle (right, scalene, isosceles, and equilateral), parallelogram (including square and rectangle), trapezoid, circle, regular polygon, prism, cylinder, cone, and sphere?

3. Can he with a ruler and compasses construct a circle, a square, and a rectangle, transfer a line segment and an angle, bisect a line segment and an angle, copy a triangle, divide a line segment into more than two equal parts, draw a tangent to a circle, and draw a geometric figure to scale?[4]

If the program is to be evaluated in mathematical terms, it should be planned that way and called by the name that describes it. Some elementary schools

[3] *Op. cit.*, 203.
[4] *Op. cit.*, pp. 197–198.

already have made substantial modifications in their programs and are using the broader term *mathematics*. The practice should be accepted generally.

A SECOND principle to be considered is: *The function of the field of learning should be indicated clearly to define its unique function as distinguished from other fields in the curriculum.*

Each field of learning has a function that differentiates it from other fields, whether they are integrated, fused, coordinated, or kept separate in actual practice. The function of the mathematics program is to develop quantitative intelligence in dealing with all phases of living. If this is accepted as its *raison d'etre,* this broad function can be broken into some workable subpurposes, namely, (1) to help children learn to think quantitatively, (2) to help them communicate quantitative facts and ideas, and (3) to help them solve quantitative problems.

Each of these functions, or purposes, is important. Each can be translated into behaviorial terms indicating the mathematics concepts, skills, principles, and generalizations to be learned. These behaviorial definitions can serve as the basis for curricular planning and evaluation.

A THIRD principle is: *The fundamental purposes of the program should be (1) clear enough to be of practical use in selecting what is to be taught, (2) important enough to endure throughout the entire period of schooling as a basis for developing a sequential program.*

The three purposes of quantitative thinking, communication, and problem solving are adequate for a developmental sequence from infancy to senescence.

The Committee's list of twenty-six items—"essentials of functional competence"[5]—will be useful when reorganized under functional headings in a developmental sequence, which is here suggested as a next step. Since the report is intended more to stimulate further thinking before final recommendations are made than to offer any final answers, each main function will be sketched briefly in turn in what follows.

One main function of a mathematics program is to help maturing boys and girls to think intelligently about quantitative aspects of their environment—remembering that today's environment is as large and as complex as the radio and other means of vicarious experience make it. Each person daily is in situations that require some sort of thinking about number, size, form, position, and their interrelationships. Whether he "thinks to himself," communicates his quantitative ideas, or applies his thinking to solving problems, it would be helpful if the "key concepts, skills, principles and generalization" referred to in mathematics programs could be stated clearly and simply in this context.

The unique function of mathematics in human affairs is in quantitative activities—dealing with number, size, shape, and position.

There is reason to believe that children are interested in and have use for all four categories and that an elementary program should deal with all four of them. A recent study of over 4,000 quantitative questions asked by children shows that they asked more questions regarding position and size than they asked about number. A study of syllabi and textbooks reveals that most courses of study and textbooks restrict mathematics in the elementary grades to number, with only a superficial treatment of measurement and

[5] *Op. cit.*, pp. 197–198.

practically no mention of position and shape until the seventh and eighth grades. Since concepts of number, size, shape, and position are essential to mathematical competence of both adults and children, and important in mathematics *per se,* all four categories should be included in a developmental mathematics program throughout the elementary school.

Concepts of number should help children know what quantity *means,* that numbers tell "how many" or "which one," that one can find out "how many" by counting, adding, and other fundamental processes. Gradually children should develop concepts of what the number system means and of how it operates and should acquire facility in its use. Such treatment of number, in connection with concrete experiences, and later with pictures, written materials, and mathematical symbols, would do much to offset what has been termed "meaningless manipulation of numbers" or "not knowing when to add or subtract, multiply, or divide."

Concepts of size, or measurement, are basic to intelligent quantitative thinking, communication, and problem solving. Children are growing up in a world in which practically everything can be measured. The mathematics program should be broadened and deepened to include conceptions of (1) why we measure, (2) what we measure, (3) how we measure, (4) why standard units and instruments are essential. Some such outline as the following might be used:

1. Develop concepts of why we measure.
   (a) To find what size, or how much.
2. Develop concepts of what we measure, and in what units.
   (a) Space can be measured to find size—in terms of *distances* (how far, how long, how high, how wide, how deep), *surface areas,* and *volume* (of solids, liquids, containers).
   (b) Time can be measured to find: what time, how much time, when.
   (c) Speed can be measured to find how fast.
   (d) Temperatures can be measured to find how hot, or how cold.
   (e) Money can be measured to find value.
   (f) Anything that is quantitative can be measured if it becomes important to know *how much.*
3. Develop concepts and skills of how to measure different things, including an understanding of:
   (a) The purposes for which the measurements are made and what is measured.
   (b) What units are used.
   (c) What instruments are used, and how to use them.
   (d) What methods are appropriate, as: estimating, measuring.
   (e) What tolerance is permitted accord- to purpose.

Take linear measurement as an example. Instead of teaching "linear measure," the elementary program should aid children in developing conceptions (1) of space and special relationships, and of why people need to find *how far, how high, how long, how deep;* (2) of how linear space can be measured with such instruments as a foot rule, a yardstick, a tape line, an altimeter, a speedometer; (3) that the standard units of measure are inches, feet, yards, miles; (4) that measurement is always approximate, by estimate, by actual measurement, or by computation; (5) that the purpose of measurement determines the degree of precision required.

Concepts of geometric forms and of position should be included in mathematical programs from kindergarten on through the grades. Children are exposed to geometric forms very early; they observe and use them in their play and home and school activities. Concepts of size, shape, and position are important in their everyday experiences. They need not be precipitated into "geometry" in later grades without realizing that they have been "having geometry" of significant nature while they

were constructing replicas and models of buildings, furniture, and equipment, while they were laying out reproductions of farms, communities, or airports, or while they were drawing plans.

We need to be mathematically literate in order to perform the second principal function of mathematics, that of enabling us to communicate quantitative facts and ideas. What these facts and ideas are depends upon circumstances, but they can be predicted roughly by observing the kinds of facts and ideas that occur in ordinary avenues of communication—conversation, newspapers, magazines, books, talkies, movies, and so forth.

The Commission refers to this phase of the functional mathematics program as "functional literacy" and emphasizes the fact that whatever functional literacy means "it is clear that modern technology has stepped up the minimum requirements of literacy in communication."[6] In general this phase of mathematical competence has been overlooked or treated as "informative arithmetic." To undertake this job seriously we must consider two points: (1) the quantitative aspects of the content must be understood, and (2) the ways, or forms, in which quantitative facts and ideas are communicated must be taught.

The second point can be broken down into the following specific subpurposes which describe what is to be taught and why:

1. Learn to communicate quantitative facts and ideas effectively—
   (a) In ordinary speech and writing which require quantitative words and mathematical symbols.
   (b) By reading intelligently quantitative facts that occur in ordinary written and printed materials.
   (c) In tabular forms, such as schedules, itemized lists, bills, tables (and in later years statistics) in which quantitative facts are organized in columnar arrangements.
   (d) In graphic forms, when data are more vivid if visualized in conventional "mathematical pictures."
   (e) In maps, which convey facts of position, positional relationships, distance, elevation, and so forth.
2. Learn to interpret quantitative facts and ideas expressed in the above form.

A recent examination of curriculums of study and textbooks for lower grades shows that most of these items are omitted in lower grades, except by implication, or are included as discrete items unrelated to their actual significance in communication. The mathematics program, beginning in the earliest grades, should contain a sequential program to develop this aspect of literacy, graded both by the development of the technique and the difficulty or complexity of content.

The third main function of mathematics is solving quantitative problems. Although this is stressed in literature of the field, much remains to be done in helping children (1) learn to recognize, organize, and state quantitative problems of genuine concern to them, (2) organize data, (3) apply appropriate computational skills, and (4) check results. As yet many of the "problems" they are expected to solve are too remote from their interests or too adult to require much momentum toward their solution. Textbook problems, upon which teachers lean heavily, are at best but examples of problems.

THIS leads to the fourth principle: *Any program in mathematics must have three characteristics: (1) it must be socially significant if it is to be useful in ordinary life situations; (2) it must be of concern to the learner if it is to motivate him to learn; (3) it must be mathematically meaningful if it is to contribute to competence in using mathematics with understanding.*

A mathematics program socially significant and mathematically meaningful

[6] *Op. cit.*, p. 196.

requires two things: First that the social situations used must be of genuine social value, and they must be of sufficient present concern to children to afford satisfactory connections between life situations and mathematics—mathematics makes sense; its usefulness is easily perceived. Second, that the quantitative aspects of these socially significant experiences must be identified clearly as mathematics and treated as such.

In general, most present courses of study fall into two broad classes: (1) those which base the mathematics programs on significant experiences without defining what mathematics is meaningful; and (2) those which list mathematical outcomes without indicating their relationships to socially significant experiences. A synthesis of prevailing ideas from both schools of thoughts will net a sounder program than either one by itself and meet mathematicians' recommendations that a good mathematics program must be socially significant and mathematically meaningful.

To date there are no comprehensive data that include all of the possibilities of quantitative learnings in the total curriculum for each grade. Such studies as have been made have been confined to a few places and to limited phases of the curriculum, such as social studies units of work or play activities. Unless such thorough analyses are made, a meaningful mathematics program geared to children's significant problems cannot materialize.

A study now under way indicates that a large per cent of the questions children ask are quantitative in nature; that curricular expectancies in the combined fields of social studies, science, art, language, and reading are heavy with quantitative requirements that children are supposed to meet somehow; and that a full and rich mathematics program could be developed in connection with appropriately planned experiences. We need more studies of this type before deciding finally whether or not a meaningful mathematics program can be based upon experiences of social significance to children.

The fact that "incidental" mathematics has been spotty, unsequential, and unsystematic in the past probably can be attributed to two factors: (1) the curriculum lacks genuineness and social significance; (2) the quantitative aspects of it have not been identified upon valid criteria and then organized into a suitable mathematics program. More work along this line is needed.

Long-time curricular planning should include: (1) careful and comprehensive planning of increasingly better experiences for children; (2) efforts to identify those which are meaningful from the standpoint of mathematics; (3) a clear-cut list of mathematical purposes, defining in behaviorial terms the concepts, skills, principles, and generalizations essential to the realization of these purposes; and (4) the use of such a list of criteria by teachers and course of study makers in identifying meaningful quantitative aspects of children's experiences and determining the conditions under which mathematics is learned functionally.

IT is to be hoped that the time and effort now being expended in the field of mathematics will eventuate in a developmental program from kindergarten through college that is (1) appropriate to the maturity and concerns of children and young people; (2) systematic and comprehensive enough to assure mathematical competence requisite to twentieth century living; and (3) of sufficient social significance to be useful in dealing meaningfully with bona fide social situations requiring quantitative intelligence.

Mathematics in General Education

By HARRIETTE BURR

Too often curriculum makers and teachers when working in the field of secondary school mathematics concern themselves exclusively with ways of teaching better the mathematics which now composes the secondary curriculum—algebra, geometry, and so on. But in her article, Miss Burr points out the need for asking ourselves: What attitudes and activities in mathematics are desirable for every student? She herself supplies nine points in answer to the question.

Miss Burr has transferred this year to the San Jose secondary schools after having been head of the Mathematics Department in the Ventura Junior High School from 1940 to 1945. From 1943 to 1945 she was treasurer of the California Mathematics Council.

FOR a century teachers have provided for the vocational needs in mathematics of the potential scientist and engineer. For the last two decades they have been considering the mathematics needed in the work of the skilled craftsman, the domestic and farm worker, et cetera. But not until 1939 was *Mathematics in General Education* published by the Progressive Education Association.[1]

There *are* general needs for mathematics which are shared by every student. Whether he is a farm hand or a lawyer, every adult must make his own decisions with respect to various consumer, social, economic, and political problems. During student years, training is needed in recognizing and solving quantitative aspects of these problems. Consequently, in evaluating the two reports which have been presented recently,[2] the question arises: *To what extent do the reports provide for the quantitative interpretations needed by the adult as a consumer, as a citizen in a democracy, and as a cultured being?*

AN analysis of the reports on this basis must be made in terms of the attitudes and activities which are desirable for every student. These include the following:

FIRST, the adult must recognize and be able to work with the quantitative aspects of consumer problems. Where in our school curriculum are such questions as these answered:

1. Is an orange 2½ inches in diameter worth twice as much as an orange 2 inches in diameter?
2. What are the dangers of borrowing from a loan shark, and how can he be recognized before the loan is made? (We teach our pupils the principles of borrowing and about the various kinds of notes, but where do we prepare them for their encounter with the loan shark?)
3. Why is it necessary to use caution in the selection of an insurance company, and how should a choice be made?

The list of such questions is almost endless. Yet today most textbooks present only an understanding of a business or consumer routine. We need to

1 Prepared by the Commission on the Secondary School Curriculum of the Progressive Education Association, D. Appleton Century Co., 1938.

2 Commission on Post-War Plans of the National Council of Teachers of Mathematics, "The Second Report of the Commission on Post-War Plans," *The Mathematics Teacher*, 38:195–221, May, 1945. Subcommittee on Mathematics of the California Committee for the Study of Education, *Report of the Subcommittee on Mathematics of the California Committee for the Study of Education*, a pamphlet mimeographed by Professor Harold M. Bacon of Stanford University, chairman of the Subcommittee, March, 1945.

supplement this with practical questions or danger points which might arise. Clearly, more time is needed in which to present such topics.

Both reports mention the need for considering consumer problems. However, it would have been helpful to us if they had presented a more detailed list of consumer questions, with a suggested bibliography for the study of each.

SECOND, as a citizen the adult must recognize the quantitative aspects of social and economic problems and be able to gather data to prove his point. Vested interests often attempt to arouse the emotions of the public. If the voter is protected by an attitude of seeking the indisputable, quantitative interpretations, he is less likely to be swayed by an emotional presentation. Yet where in the mathematics curriculum of today does the student have any experience in recognizing the quantitative aspects of such current social and economic problems as socialized medicine, free college education for capable students, Federal support of education, or a work-week of thirty hours.

Here again the reports barely mention this activity in the list of fundamentals of arithmetic; yet it needs much elaboration because of its power in aiding the voter to understand all phases of an issue.

THIRD, both students and adults should experience the joy of creative work in mathematics. For some this will lie in geometry or higher mathematics. But *all* may share in this experience in the area of quantitative interpretations. To feel that he has forged a new link, that a quantitative interpretation is his alone—not only is this a joy, but also a stimulus to further work. Yet neither report presents this general need.

FOURTH, it is helpful to every adult to have an intuitive feeling with respect to the solution of one-step algebraic equations, to be able to solve simple formulas, and to understand the meaning of signed numbers.

The equation of assets and liabilities in bookkeeping, the formula in industrial work, the proportion in household and agricultural work, the use of signed numbers in bookkeeping or games such as "Rummy"—all illustrate that almost every adult can *use* an understanding of the basic concepts of the equation and of signed numbers. But is *every* student who leaves our school equipped with these useful understandings?

Fortunately, both reports list these items among the desired fundamentals.

FIFTH, the adult needs to recognize and measure various geometric figures. To purchase material for a triangular scarf, to name the Pentagon Building, to appreciate an octagon in architectural form—these are a part of everyday life and are included in both reports in the lists of fundamentals of arithmetic.

SIXTH, the adult must interpret, and sometimes construct, certain mathematical forms used to present quantitative facts: *e. g.,* tables, maps, and graphs. Here again both reports include these items in their lists of fundamentals.

SEVENTH, the cultured citizen needs an appreciation of the rôle of mathematics in the development of civilization. How many of our students realize that the elevator of today would have been impossible if Galileo had not known how to summarize his findings with respect to falling bodies in a formula? Medicine, radar, television—each new development would be impossible without mathematics. Yet to what extent do present textbooks depict this cultural phase of mathematics? Worse, how many motion pictures are available in film libraries which illustrate the development of civilization as a result of a new development in mathematical thinking?

Unfortunately, neither of the reports mentions this phase of general education.

EIGHTH, the adult needs to solve problem situations. He must be able to read—instructions in the income tax form, or data on an office memorandum. He must be able to select the data which have a bearing on the solution of his problem. And he must recognize key words, or know how to manipulate his data so as to solve his problem.

Again, both reports specify training for this need.

NINTH, the adult needs to compute with ease. Handicapped is the man who has a block so that he will use every possible means to avoid a computation. Certainly there should be no fear nor dread of computation. Neither should there be clumsy, round-about methods of solution. Rather, there should be complete confidence and facility in any arithmetical process.

Both reports reiterate again and again that "functional competence" is vital to all; and both reports prescribe "review" for the pupil who has not attained the necessary competence. Yet this is the most perplexing of current problems in the mathematical classroom: *how* to present a topic which was treated in preceding years, but which only part of a class has mastered.

The problem is especially difficult because no two students have the same deficiencies. In a typical ninth grade class in general mathematics, one student has trouble with long division, another has not mastered the addition of fractions, and still another has not yet learned his multiplication combinations.

Both reports give an excellent skeleton for presentation of this type of work.

IN describing a course in remedial arithmetic, the California Subcommittee states, somewhat optimistically, that

"It is customary . . . . for the teacher to give frequent tests, to pay close attention to individual progress, and to give as much attention to individual pupils as time will permit. The most effective instruction can be given when the particular deficiency has been discovered. There is no economy in giving a general review of arithmetic in the hope that every student will eventually have his particular deficiency touched upon and, possibly, removed."[3]

The national Commission describes the continuation of arithmetical development by saying

"Disabilities in arithmetic should be located at the earliest possible moment with the aid of reliable inventory or diagnostic tests. An adequate remedial and maintenance program should be regarded as an integral part of the curriculum. . . . . Mere repetitive drill, devoid of real understanding, only aggravates the situation. A remedial program or a refresher course which is not anchored on insight cannot be expected to produce lasting results. The secret of success in arithmetic is meaningful learning combined with intelligent practice and functional application. . . . .

"The shortages in the mathematical training of young men entering the armed forces have in some quarters been attributed merely to 'forgetting.' However, there is convincing evidence that lack of understanding of the key concepts and principles, and of mathematical modes of thinking, is primarily to blame for widespread mathematical incompetence. The remedy is obvious. As Professor Dewey pointed out long ago, skills cannot be used effectively unless intelligence has played a part in their acquisition. Mechanical drill is not a substitute for understanding."[4]

Although these statements are essential, yet they are too brief to be of

[3] *Op. cit.*, p. 21.
[4] *Op. cit.*, pp. 204–205.

help to a teacher floundering with this problem of developing computational skill at the secondary level.

Many computation processes are complex. They are composed of several simple processes which it is necessary for the child to understand and master separately before he can attain skill in the complex process.

For example, long division is composed of several basic concepts:

1. Mental addition for the carrying of partial products in multiplication.
2. Subtraction in every type of difficulty.
3. Mental multiplication of a 2- to 4-digit number by a 1-digit number.
4. Division combinations.
5. Trial divisor.
6. The meaning and form of long division.

Certainly, if a child is not successful with any of these processes, he will not master long division. But one often hears, "I have given these students problem after problem in long division—long, hard problems. Yet they show no more mastery at the end of the semester than they did upon entering the class." Usually in these cases no attempt has been made to break long division down into its component parts. Neither has there been any attempt to ascertain whether the student was successful with each degree of difficulty of each component part.

It is vital that the development of each process start with its most simple phase. If a student is having difficulty with the more difficult phases of a skill, there can be no assumption that he has mastered the most basic concepts. Only an inventory test of the particular basic concept will show this.

For example, in building understanding and mastery of addition of integers, the sequence would be:

1. Combinations whose sum is less than 10.
2. Combinations whose sum is greater than 10.
3. Columns of 3 figures, then of 5 or 6 figures.
4. Two columns of 3 figures each, then of 5 or 6 figures.
5. Three and four columns of 4 or 5 figures each.
6. Irregular columns.

In this way the process is separated into its simplest steps, then the next hardest steps, and so on.

Before the teacher can finish the preparation of her students for success with long division, she must separate similarly multiplication, subtraction, and short division into the simplest steps and gradually develop them to competency. Then, and only then, will the student be able to work effectively with long division.

As both reports state, it is futile to give all students in the same class the same remedial assignments. Precious time is wasted in reviewing a process needed by a few students, but mastered by most of the class. Instead, while one student is developing basic concepts and skill with additive processes, other students will be locating their difficulties in subtraction or fractions and will spend their time in remedying their own individual defects.

Fortunately, there are materials which provide for such an individualized diagnostic and remedial program. The teacher's task is to supervise, to make certain that each student understands completely the process which he is seeking to master.

Nor is such a diagnostic and remedial program sufficient. The teacher must make certain that each process has significance and meaning for the pupil. Before real learning can take place, the pupil must experience a use of the

process in the working world—he must see a need for the process. More, he must feel some need for this process within his own life so that there is an immediate urge to master the concept. Not until these steps are taken is the pupil ready for any true remedial work.

True, the junior or senior high mathematics teacher is a secondary teacher, not a primary teacher. The students in his classroom are adolescents who are experiencing their first dates, holding their first jobs, going to their first football games. Their social and physical development makes these students a part of the secondary school. But if these students need careful reteaching of third-grade arithmetic, then these topics become a part of the secondary curriculum. The teacher is still a secondary teacher, but he becomes a *broadened* secondary teacher who can present any needed content at will. The primary and intermediate teachers have long worked on the most effective methods of presenting arithmetic. Secondary teachers might well investigate their methods—there are none better.

AT present most consumer and social issues are left to the social studies, home arts, and commercial classes. But is this enough? Do the pupils develop the desired attitudes, or is a further contribution needed from our own department: mathematics?

After a discussion by the social studies class, a student often has the same attitude toward the issue as at the outset: a conclusion based on his parents' beliefs and emotions, rather than on the many phases of the issue presented in class. But a quantitative interpretation is indisputable. Certainly more time is needed for experience with the quantitative aspects of current social and consumer problems.

It is not enough to give our future scientist or engineer only the algebra-trigonometry sequence. Neither is it enough to require algebra and geometry of our college-preparatory students. These are the potential leaders of society. Theirs will be the responsibility of making decisions and of working for support of these decisions. They must have experience in studying the quantitative aspects of consumer and social problems not now included in their curriculum, of understanding the needs of all types of citizens.

Neither can the development of arithmetical competence be dismissed with a mere "review." The very lack of success in computation, to which both reports discussed herein point, is evidence that more than "review" is necessary. Only a careful, detailed program in diagnosis and remediation will answer the vital need in computation.

Thus, additional time is needed in the curriculum for developing the arithmetical competence and quantitative experiences which each student will need as a consumer, as a voter, and as a cultured being.

New Issues in "Occupational Briefs" Series

Recent issues in the Science Research Associates series of *Occupational Briefs* which have been received for review in the California Journal of Secondary Education include the following:

No. 106—"Politicians."
No. 107—"Consumer Coöperative Workers."
No. 108—"County Extension Workers."
No. 109—"Painters."
No. 110—"Bookbinders."

Published at 228 South Wabash Avenue, Chicago, the Briefs sell for 15 cents each.

Planning a Program for Use Of Learning Aids

By RALEIGH SCHORLING

A SINGLE building in Washington (Special Devices) has more than $200,000,000 worth of devices designed for the improvement of learning in the training schools of the Armed Forces. This amount undoubtedly exceeds the value of the equipment in all the psychological laboratories of our higher institutions. The Army Air Force alone used more than 2,200 training aids.

Let us be clear on one point. Training aids as used in the Armed Forces include much more than something on a screen. It is estimated that the Armed Services since 1940 have created six times the quantity of audiovisual aids provided for use in civilian education in all the time before World War II. Nevertheless, training aids include many other devices for which the figures, as regards utilization, are equally fantastic.

The basic assumption underlying training aids is that learning—clear understanding—stems from sense experiences. The pedagogical guide is: Whatever is to be mastered should be learned in its natural setting, or in a situation that is staged as close to the real situation as possible.

ONE of the striking features of the GI method is the wide use of a great variety of training aids which provide realistic learning situations. These include: (1) films (movies and slide films—both sound and silent); (2) two dimensional graphic devices (photographs, posters, cartoons, diagrams, scale drawings, graphs, maps, charts, graphic portfolios, and so on); (3) three dimensional objects (models, mock-ups, sand tables, diaramas, terrain models, real objects, and so on); (4) auditory aids (phonograph records, devices simulating sound, and so on); (5) special devices (mock-up of a pilot's compartment, Link Trainer, model topography classroom, miniature planetarium, globe with blackboard surfaces, pinball machine, and so on); (6) printed materials (books, manuals, bulletins, pamphlets, periodicals, and so on).

It will be difficult for civilian edu-

Last summer, twenty-six Michigan superintendents and principals, all beyond the M. A. degree, visited Service training schools in seventeen installations on the Eastern seaboard with the purpose of studying what civilian education can learn from Service materials and methods—it is not likely that any other civilian group will have as wide contacts with training schools, for such installations are being closed or cut back rapidly. It was the conviction of the Michigan group that the most valuable contribution to pedagogy which the Services have made is in the area of training aids. In charge of this traveling workshop was the author of this article.

Dr. Schorling is professor of education at the University of Michigan and directs the education of mathematics teachers. He is the author of numerous textbooks in the field and during the war has served as a full-time consultant in the Training Courses Section of the U. S. Navy. Because of his outstanding work in the fields of mathematics and in learning aids, he was asked to contribute the "Journal's" October out-of-state article as a part of the symposium.

cators who have not seen the training programs to appreciate the range, number, variety, and effectiveness of the learning aids employed in the school of the Armed Forces. Hundreds of classrooms, without exception, were serviced with a wealth of instructional aids—in most cases highly appropriate to specific objectives.

The classrooms looked very different from our academic classrooms. Roughly, one might say that the principle underlying the settings of good first-grade activities has been utilized for adult education purposes. Most teachers will admit perhaps that too often our rooms lack equipment—that they are so barren as to suggest mere detention or custodial care of children. Then, too, many schools operate on the assumption that a subject in high school can be taught in any vacant room. The Army and Navy have changed all that by covering the walls of the classrooms with posters, cartoons, photographs, and so on, and by providing films and numerous gadgets, all of which drive home the main ideas of the unit that is being taught.

The rapid development of the training aids program by the military was not a miracle—it came direct from civilian education. For example, the Navy gathered together about two hundred men who in civilian life had had wide experience in visual aids. These men were given the very challenging problem of providing realism in the classrooms of the Navy the world over. Their imagination and resourcefulness, implemented by vast sums, resulted in a classroom that looks different from the typical academic classroom and which is a far more exciting place for the learner.

Admitting that many teachers already are using visual aids in helpful ways, we see clearly that the gap between the use of learning aids in our civilian schools and the training aids in military schools is too great. This leads to the following recommendation:

We Need to Make Greater Use of Sense Experiences When Staging Learning Situations.

THIS area, if intelligently cultivated in the years ahead, might yield a real improvement in our schools. It could happen that any city, state, or teacher's educational institution which neglects this problem may find itself outmoded ten years hence. Before we go all out for a program in learning aids, however, we should recognize that we can go off the deep end in many places. Here, for example, are some common ideas about learning aids that may need to be modified or even discarded before a sensible program can be provided:

"Phoney" Ideas	Refutation
1. When you do find a good film you should dismiss a lot of classes in order that they all may see it.	1. We might call this the shotgun technique. Since you have a good gun, it seems reasonable that you will hit something if you scatter your shot over a wide area. The whole school on exceptional occasions may, of course, need to see a film. But in general, a film needs to be geared to a specific objective in a unit of instruction.
2. Training aids, as used by the military, are limited to the teaching of science and the arts, and, therefore, they are of no great interest to teachers of other subjects.	2. The Army used training aids with great success in teaching attitudes, as, for example, morale and the traits of a good soldier. Learning aids should prove to be especially useful in the social studies, in fixing the dispositions that make for good citizenship.

"Phoney" Ideas	Refutation
3. The phrase, learning aids, refers largely to sound films.	3. As has been suggested, sound films, while used in fantastic numbers, are nevertheless a small part of the total picture of training aids.
4. The way to make a big improvement in the existing program of visual aids in the school system is to secure a lot of surplus property.	4. Much of the surplus property will have no useful purpose in our schools. The task of judicious selection will be very difficult, and in many cases the teacher will not know how to use some of the materials.
5. We can take over the training aids of the military without a research program.	5. A good training aid is one that stems from a classroom need and one which has been tested to see if it is better than any known device. Before an aid is released for wide use, it should have the "bugs" taken out of it. The Army training aids program could not have succeeded without careful testing of individual aids.
6. Learning aids are useful mainly in teaching skills and information.	6. As has been suggested above, they may prove equally useful in the teaching of attitudes. Their use in civilian life is illustrated by certain aspects of bond drives and advertising campaigns.
7. A learning aid is an end in itself.	7. This fallacy is perhaps obvious.
8. A city like Los Angeles should develop a department of audio-visual aids separate from the curriculum.	8. There is no justification for a learning aid that does not implement some objective of the curriculum. In sound administration, the learning aids program will be subordinate to the curriculum.
9. A learning aid is a substitute for a teacher.	9. A good program of learning aids increases the importance and responsibilities of a teacher. When properly used, a learning aid frees the teacher for his important task of guiding the learning process.
10. The teachers of the various school subjects have little to contribute to a program in learning aids.	10. In a good program, many valuable ideas will come from classroom teachers. Moreover, teachers, especially those in industrial and fine arts, will make many of the aids observed in our study, when they realize the possibilities and provided they are given the materials and the time.
11. The supervision of a program of learning aids is an extra job on top of a full teaching load and not unlike the sponsorship of an extracurricular activity.	11. It is inconceivable that a teacher or even a committee on full-time teaching could guide a program of consequence in a large school, not to mention a city system.
12. With proper guidance the staff can do all that the Army and Navy have done with training aids at very little cost.	12. As already has been implied, some things can be done without much cost, but a really fine program will cost money—lots of it.
13. Learning aids amount to a passing fad—all we need to do is to ignore the present emphasis and to wait it out.	13. We shall always have persons who have difficulty grasping abstract ideas. Competent teachers always will be aware of this fact, and they will try to do what they can to provide vivid illustrations. A good school will see to it that learning is not unnecessarily difficult.

"Phoney" Ideas	Refutation
14. All we need to do to solve the problem of learning aids is to get the legislature to appropriate one or two million dollars to buy visual aids.	14. At least one state has passed such an act, and in the surge of interest for visual aids others may follow. A considerable fraction of such sums may be frittered away by the numerous districts in buying visual aids that will not fit specific units in the curriculum, and in a short time the materials may be stored on shelves—provided there are shelves.
15. The problem will be solved if enough teachers take professional courses in visual aids.	15. No doubt such courses are helpful, but they are not sufficient to create and maintain a vital program in visual aids.

UNDERLYING the preceding discussion is one important guide. It is that the chances of making a substantial beginning on a good program in learning aids without making provisions for selecting, testing, and utilization are very low. The schools of the Armed Forces have taken over the ideas of professional education, and they have made them work. How they did is reflected by the following recommendations:

1. *The Schools of a State Need One or More Development Units Charged with the Responsibility of Creative Production, Reliable Testing, and Proper Utilization.* What should such a unit do? Precisely what the recommendation implies. It should stimulate the production of learning aids stemming from the needs of curriculum units and from the suggestions of classroom teachers. It may need to undertake the experimental production of aids. It should test a learning aid to make reasonably certain that it does the job and does it better than any known device. It should provide simple guides for teachers, especially for beginners, as to the best ways of using learning aids.

Such a unit involves far more than employing a specialist in visual aids or appointing a committee to supervise a program. Somewhere in each state we need a unit employing many full-time persons. The main idea that civilian educators need to appreciate is that such a staff, in addition to professional educators, authors, secretaries, specialists in visual aids, and experts in testing techniques, must include highly skilled workers drawn from the fields of the arts and sciences. We realize that this recommendation, if carried out, will soon confront us with several very perplexing questions for which we have no answers. But that is all the more reason why we should, somewhere in a state, provide a center guided by experimentation and systematic research.

2. *The Faculty of a School Should Have a Standing Committee on Audio-Visual Aids.* Nearly every faculty has a few members especially interested in visual aids. They should be encouraged to develop their hobby. Working as a standing committee they can make themselves exceedingly useful to a school.

The efforts of such a committee might well utilize the imagination and resourcefulness of certain students who also are greatly interested in visual aids. The numerous services that a standing committee on visual aids can render to a faculty are perhaps obvious; only a few will be listed here:

(*a*) Avoid undesirable duplication.

(*b*) Provide teachers from time to time with a brief list of really useful materials. There are not as many valuable movies and slide films as the catalogues suggest. Obviously, useful mate-

rial that is free or which can be obtained at low cost should be featured in such a list.

(*c*) Guide the faculty in the careful selection of surplus war property. Much material will become available for civilian schools in the near future.

(*d*) Help the classroom teachers to manage visual aids.

(*e*) Improve the ways that teachers use visual aids. Although many teachers make good use of visual aids, it is clear also that much which is now done in the name of visual aids is a waste of time and money.

(*f*) Exercise a caretaker function over the visual aids now possessed by the schools. If there is not a central place in the building for aids used by more than one department, the equipment tends to be lost and new teachers especially may not learn for a long time that it exists.

A standing committee, such as is here suggested, might well use at least one faculty meeting per semester to discuss its continuous survey and its recommendations relating to proper utilization of visual aids.

3. *The Resourceful Teacher Should Be Given Guidance in Writing the Script for a Slide Film.* To the reader it may seem trivial to focus attention on a specific learning aid. Probably he would prefer that we describe the scores of fascinating learning aids that will be immediately useful if and when they are released to civilian schools. We could, for example, describe new and better projectors, a miniature planetarium built at a cost of $140, globes with blackboard or transparent plastic surfaces, three dimensional mock-ups showing weather conditions. Interesting as it might be to discuss this endless array of new aids, we believe it a responsibility to make a case for the slide film.

There are good reasons for believing that a teacher can make a significant improvement in his work by the wider use of slide films. The slide film or filmstrip consists of a series of "frames" that may be projected on the ordinary wall of a classroom—the room does not need to be darkened. The filmstrip technique has the very great advantage that a single slide or frame may be held on the screen or wall for a period of time that is adequate for careful study. Other things being equal, a slide film is of most use if it is built into a unit to achieve a specific objective. Moreover, a group of related slide films can give continuity in the development of a curriculum unit.

Fortunately, the writing of the script for a film strip is not too difficult for a resourceful teacher. Teachers with imagination and in favorable school situations, as, for example, with time in the school day to do the job, may in increasing numbers be disposed to experiment with slide films. If this should happen, the total number of teachers in our larger cities will be more than adequate to provide a complete set of slide films for every curriculum unit that can be illuminated by this technique.

However, the project will need coördination. The increased interest in film strips is likely to engulf the teacher with a flood of slide films—a few per hundred good, and the rest useless or even bad. Selection might easily turn out to be an impossible task.

The administration, by an appropriate organization, should sponsor, guide, and coördinate the production of an excellent collection of slide films for each course or unit. It could promote such a program by (*a*) providing the necessary directions for writing the script, simple as they are, for making a slide film; (*b*) giving generous recognition to the person or persons creating the slide films; (*c*) using the audience

situation in departmental or faculty meetings for the selection of the best slide films before release; (*d*) giving publicity throughout the system to the film strips selected; (*e*) providing a brief statement of the purpose and proper use of each film strip.

4. *Each Association of Administrators, in a State and in the Larger Cities, Should Have a Standing Committee on Learning Aids.* There are many practical and perplexing administrative problems that are likely to confront us even if the trend toward learning aids goes no further than a moderate extension of audio-visual aids. To state a few:

(*a*) Are our buildings so planned that we can manage a good program in audio-visual aids? Do our classrooms have adequate storage space? It seems that moving the extensive equipment of learning aids observed in any one of the training schools into a conventional building with its limited storage and bulletin board space and its low provision for projection facilities would create a situation of disorder and confusion. The training schools place special emphasis on keeping everything out of sight except that which is being demonstrated at the moment. Buildings for the future may need to be planned with vision of things to come.

(*b*) How are the new materials to be administered? Let us assume again that the movement toward learning aids will go further than a normal increase in movies and film strips—both sound and silent. Will these become a responsibility of the library? If so, will the library have the space and the personnel? If not, shall we develop a new department parallel and comparable in its services to the library? Sooner or later the responsibility for a coördinated program must be placed somewhere.

(*c*) How can we select good learning aids from the many commercial aids that are likely to be made available? A "county fair" exhibit of new learning aids might well be provided by the different state departments of education or in the summer sessions at institutions for teacher education.

(*d*) How can a teacher get a movie or a film strip on the day that it is needed? In a school of the Armed Forces, a learning aid moves with the unit of instruction of which it is a part. In a civilian school, a teacher may get a film a week after she has completed the unit; naturally that is deeply discouraging.

(*e*) Do we have to create a specific aid, as, for example, a slide film on electricity, in every town, city, or school district? We should manage matters so that a teacher in Town A may be able to use an excellent slide film created in Town B without too much grief and expense.

The difficulty is not unlike that met in our futile struggle to revise the high school curriculum. Our curriculum specialists inspire or belabor teachers to try to produce new units and better courses of study. Too often the staff of each little school "goes it alone." The job often is done after school hours by tired teachers relying to no small extent on scissors and paste technique. Often they do not bother to examine an elegant unit with precisely the same specific objectives that has been constructed by a less weary group of teachers, perhaps even in the same state.

As Ralph C. M. Flynt neatly expresses it,[1] they engage in "rediscovering America," or else they sink into unproductive lethargy. The problem is: What is the minimum sized school administrative unit for a reasonably good program in audio-visual aids? Must our small school districts go through the

[1] In a forthcoming report entitled "The Use of Training Aids in the Armed Services," to be published by the Office of Education, Washington, D. C.

same wasteful experiences as regards visual aids that we have followed in curriculum revision? Will the remote schools drop still farther behind on the road to progress? Perhaps we can come to larger districts that will allow the free trade of ideas and materials.

(*f*) How can an administrator find time to think about the basic policies relating to audio-visual aids, or any other problem?

The administrator and supervisor of a school in the Armed Forces has *time to think about broader policies.* The commandant of a training school has an assistant to whom he delegates *all* administrative details. The director of an activity (we would say department—as, for example, training aids, curriculum, or instructor-training—also has an assistant director completely responsible for all administrative matters. To be sure, the man at the top has the responsibility, but he does not attempt to do administrative tasks himself.

The extent to which administrators, supervisors, and directors are free to think about the broad fundamental problems of their jobs presents a sharp contrast to the setup in civilian schools. As everyone knows, the typical superintendent, supervisor, or principal is so driven by administration details that he has little time for supervision or for discussing with his teachers and his public the broad problems of policy.

5. *Our Teacher Education Institutions Should Provide at Least One Good Course in the Proper Use of Learning Aids.* The content of such a course is, we trust, suggested by this section. In addition to acquainting students with the more important learning aids in the fields of their special interests and the proper use of such aids, the course should confront the students with verbal presentation of ideas and principles and require them to design, or at least suggest, the proper use of available training aids in the effective teaching of such ideas. If, for example, we ever come to agreement as to what we mean by such words as essentials, core, and common learnings, then it would be helpful to teachers to be equipped with the knowledge of the proper use of learning aids.

IN summary, we can say that the Service training schools would have failed to accomplish their job in the time they had to do it if a great variety of training aids had not been available and used appropriately by instructors. There was not time or personnel to test systematically every training aid, but there is an almost universal consensus of opinion among instructors that use of these aids to learning has motivated standards, given students a more interesting class period, broadened their experience, brought a desirable element of realism into the training courses, lengthened the period of retention, helped students formulate correct impressions, saved learning time, and, most important of all, made key concepts and principles clear and principles clear and easy to understand.

Too often our attitude in teaching is: Take it in the form that we dish it out or leave it. To exaggerate a bit, we seem almost afraid that we will make learning a thing too easy. The tragic result is that a goodly fraction of students in the typical class never knows the score.

Adult Programs in Family Living Expand

By C. EDWARD PEDERSEN

Workers in the field of adult education report that the greatest expansion in their programs during the postwar period is coming in the areas which Mr. Pedersen designates as training for family living or as parent education. What the trends are in this field is discussed in the present article.

Mr. Pedersen is principal of the Berkeley Evening and Burbank Evening Schools and Parent Education Classes, Berkeley. Previously, he had taught in the Garfield Junior High School, Berkeley, had been principal of the Summerville Elementary School at Tuolumne, and had taught in the Summerville Union High School, Tuolumne, and in the Nevada City High School. As principal of Berkeley's Parent Education classes, he has administrative responsibility for the Parent Nursery Centers conducted in his city, coöperative projects of the type described in his article.

THOSE of us who are educators and see the problems of life in all its age levels are quite agreed that education is a process carried on from the cradle to the grave. As long as one's mind is active he learns about things from others or accomplishes his purposes on his own initiative.

Elementary, secondary, and college levels of education have been referred to as the "hope of the future." We speak of adult education as the "hope of the present." Parent education or family living is the "hope of both the present and the future."

Adult education has earned its rightful place as an outstanding part of life's pattern. Its importance has become more recognized and honored because of the great part played by it in preparing almost overnight thousands, yes, millions, of men and women for employment in vital war industries. The home front has made outstanding contributions to those actively engaged in the theaters of military operations.

The tragedies of war time, the depressive spirit which grips people during periods such as we have had and are witnessing have been alleviated to a great degree by the activities of our adult education program. Men and women have come to the schools for counsel, for retraining activities, for social intercourse, for mental uplift, for recreation, for culture, for personality development, for intellectual achievement, for psychology, for nutrition, canning, and food dehydrating information, and for countless other subjects pertinent to modern living. Adult education even trained women to care for children of working mothers.

YES, adult education has earned its place during war time, but it has just as important an assignment for the years ahead.

There has been a tremendous amount of trouble in this world of ours which could have been avoided. Lack of interest for the concern of others has been the underlying cause of this condition.

Is there any plausible reason why our uncertain family relations cannot be made more stable? Is there any plausible reason why one out of every five marriages in our nation should end in divorce? Is there any reason why the

number of divorces and annulments should equal the number of marriages in one of our largest California cities?

There are ways of righting the conditions which face us, and I believe the answer is to be found in a complete, sound family living program in every locality. I would go one step further and state that a strong missionary-like effort on the part of us educators to stimulate interest and create family living classes would do more good than we are able to contemplate at present.

Family living is the basis of our civilization—if it is desirable our hopes and ambitions for all that is good will persist; if not, the future will be dark.

Now let us think about the needs of the present, the problems which can be attacked through an adequate program of education for family living. Let us visualize the trends.

MORE and more classes are being sponsored for expectant mothers by YWCA's, health departments, church groups, and school systems. It is extremely important that a prenatal being be fed and cared for properly. A healthy mother who has been given expert guidance concerning the proper care of her unborn child will, if nature is kind, give birth to a child better fitted for the world than if she had not been informed.

Infant guidance classes form the second unit of our family living series of projects. The early years of a child's life are without question the most important for his development. These classes are conducted frequently in close coöperation with well-baby clinics. Mothers and children come to the meeting places rather early in order to see the nurse and the doctor as soon as possible after they arrive.

Of course, a waiting period results when many mothers and their offspring arrive at the well-baby clinic at approximately the same time. During such periods the infant guidance leader gathers the mothers and babies around her and conducts a discussion. Mothers are taught about correct feeding habits, toilet training, food preparation, adequate clothing, habit training in general, individual guidance, and what constitutes the emotional and affectional needs of a child.

Our preschool nursery centers have satisfied a need which arose when mothers were needed in large numbers for war work. The youngsters are placed under the supervision of certificated and well-trained personnel. These war nurseries are places to which mothers studying child psychology and guidance are taken to see "children in action."

The full-time nursery idea will be continued after the war in a much less extensive way perhaps, but it has earned its right to remain as one of our American institutions. Widows and orphans, as well as those deserted by their menfolk, will, of necessity, have to be accommodated by all-day nurseries.

The finest type of nursery for children of mothers who do work is the parent-nursery center. These nurseries are coöperative ventures and are not entirely a substitute for homes. Each mother assists the leader one morning or one afternoon per week. Because she is in close contact with many children, with other mothers, and with the leader, the coöperating individual is able to perceive correct methods of child care and guidance. All the mothers and the leader gather one evening per week in the nursery, without their progeny, and carry on discussion relative to child problems and to events which have occurred during the week.

This coöperative nursery procedure gives children the advantage of parents trained in hygiene, assures them of medical and physical examinations, and

develops good social, play, rest, and eating habits. And mothers whose children are in the nursery have a few spare hours during the week when they are able to do things they do not normally have the opportunity to accomplish. This relaxation from child-care worries helps to strengthen marital ties.

CHILDREN entering the formal education part of their lives find school to be a great forward step, with many satisfactions as well as problems to be solved. Their mothers realize soon that the behavior of their children changes with their entrance into school life.

Psychology for mothers of elementary school children provides a means for parents to become acquainted with complete or partial solutions to child guidance problems.

In this phase of the program, leadership courses are carried on for leaders and future leaders of Cubs, Brownies, Scouts, Campfire Girls, and other youth groups.

At the junior high school level we find another fertile place to implant good family living habits. Children at this age are problems for their parents, their school mates, and themselves. Adolescent psychology and guidance classes are carried on for parents of children in this group. In addition to classes for parents only, there are mother-daughter, mother-son, father-son, father-daughter, and entire-family groups which study relations of one family member to another.

Sex hygiene classes are presented for parents who wish to instruct their children in the intricacies of life.

Leadership training classes are conducted for parents who wish to supervise youth groups of this age.

Classes for parents of high school youth are being conducted in many communities. Adolescent psychology, psychology for war-time conditions, and youth leadership training groups have contributed much in preventing juvenile delinquency and in preparing proper mental attitudes—for young men and women about to enter the Armed Forces, for parents of service men and women, and for wives and sweethearts of men engaged in military operations.

Premarriage psychology and sex hygiene courses are being carried on for both parents and their offspring. High school girls in these premarriage classes consider preparations for buying a home, buying a car, budgeting, and the care of babies—not merely with regard to giving a baby a bath but also instruction in how to prepare and administer its food, how to dress it properly, how to guide habit formation, and other features.

Various state groups advocate the scheduling of homemaking courses for eighth- and tenth-grade girls and boys and a family living course for college freshmen.

AT the adult level of parent education and family living we find a great many classes of all types. Adult psychology and Dale Carnegie courses are being presented for those desirous of getting along happily with others and themselves.

In personality development classes, instruction is given which enables women to achieve good health and an attractive appearance. Exercises to music, proper walking, sitting, standing, and poise development are stressed. Also considered are color harmonies, good grooming, hair styling, facial make-up, and conversation. These factors taken seriously into consideration result in pleased friends and children, as well as proud husbands.

Homemaking courses contributing in part to successful marriages include dressmaking and remodeling, millinery,

costume designing, art, pottery, plastic, weaving, nutrition, cooking, home planning and remodeling, landscape and vegetable gardening, backyard farming, and many others.

Automobile driving and simple repair courses for women have been well received and have proved especially valuable for motor corps members of the Red Cross, AWVS, and Coast Guard Women's Temporary Reserve.

Traffic safety groups study road, vehicle, and driver hazards and measure themselves with physical tests showing reaction time, range of vision, color perception, driver judgment, and other characteristics of drivers.

A unique class is being conducted in San Francisco for parents of delinquent children. There is close coöperation in this project between the courts and the school department, and reports indicate that desirable results are being obtained. The legal phases of life, physical welfare of the child, school activities, recreation facilities, employment placement service, social facilities, mental problems, religious education, and similar topics are discussed by outstanding citizens.

Classes for entire family groups assist in bringing about the realization that successful family living means the working and playing together of parents and children. Swimming, games, workshop activities, and creative courses provide for the needs of worthy family living. Dog companion training classes for owners of pets create a great amount of satisfaction not only for the owners but also for neighbors and friends.

If our motto, "Education from the Cradle to the Grave," is to persist, we must provide activities for those who are grandparents—those in the twilight zone of life. A busy mind creates happiness in all family circles.

IN the future there will be even a stronger association between the home, school, and the community. Working hours will be shorter, hours of leisure will be longer, and men and women will retire earlier in life from their professions and vocations. Fifty-five years of age will be, in all probability, the retirement age within the near future.

A country, a race, and the civilized world are only as strong as the units which compose them. Our country will contribute to the advancement of civilization only if our family units are strongly welded, well informed, eager to learn, coöperative, self-sacrificing, and outstandingly loyal. Family living courses will assist in fostering the ideal condition of life for which all of us strive.

Claremont Reading Conference Yearbook Is Issued

The tenth in the series of Claremont College Reading Conference Yearbooks, just published, develops the theme: personal factors affecting reading and learning. The six divisions of the 1945 Yearbook deal, specifically, with physiological, social, aural, visual, and bilingual factors, as well as with instructional materials, involved in the reading process.

Included in the divisions of the 1945 Yearbook are twenty-three articles by educators and specialists in the fields of medicine and psychology, stressing the importance of developing an individual with the ability to sense and react adequately, to read, in any learning situation.

The Claremont College Reading Conference Yearbooks are sponsored by Alpha Iota Chapter of the national education society of Pi Lambda Theta in coöperation with the Claremont College Library.

High Schools Need More Geography

By GEORGE W. OTT

Although they may feel that the author of this article is asking the impossible when he suggests that four years of geography be taught in high schools, and although they find him inconsistent in complaining in one sentence about the misinformation which children are given in elementary school geography courses and in the next sentence asserting that children never remember anything they read in such courses, still those who read this article will be impressed by the force of Mr. Ott's arguments for greater emphasis on geography in the high school curriculum.

Mr. Ott is a teacher of social studies at Hollenbeck Junior High, Los Angeles, to which he has transferred this year from Redlands. Formerly he taught for two years at Chelan, Washington, and for one year at Ketchikan, Alaska. He writes that his "interest stems from the firm conviction that geography is the basis for the other social sciences and from the fact that it has been relatively ignored in the secondary school."

VIEWED objectively, the fact that we have endured a prolonged economic depression and two world wars in the space of one generation is a clear indication that something is fundamentally wrong with our civilization, and therefore with the educational system from which it draws its knowledge and inspiration. Total war and economic maladjustment are but symptoms of universal political incompetence, the cause of which may be traced to the schoolhouse door.

The emphasis on the physical sciences, to the detriment of the social sciences, has resulted in a complex twentieth century machine culture being managed by political methods differing little from those used by the nations of antiquity. Politically and socially, the United States of today may be compared with the Roman Republic or early Empire, but technologically no comparison exists.

Our crying need is not for new and greater machines, but for political proficiency to control those we possess already. In order to gain an intelligent mastery of our complicated, interdependent civilization, it will be necessary for us to obtain an understanding of its nature. For this we must broaden and intensify our study of the social sciences.

Individually, the various social sciences can offer a vast amount of information vital to the preparation for citizenship. Notwithstanding, geography is the only one which integrates the entire group of social studies and provides a sufficiently broad scope to enable students to acquire a comprehensive knowledge of the earth and of the intricate pattern of man's life upon its surface.

History, political science, economics, sociology, and the allied social sciences are based upon, and closely related to, the science of geography. No accurate study of man or his institutions can be undertaken without including a "study of the earth in relation to man," which is a generally accepted definition of geography. The contributions of geographhy to the exact sciences of meteorology, climatology, and geology are obvious. However, its manifold contri-

butions to worthy citizenship directly, and indirectly, through the medium of the other social sciences, are of even greater value.

GOOD citizenship begins in the home and the local community and is based to a great degree on an adequate understanding of geographic factors. America's record of prodigious waste of natural resources, and her failure to attain a prosperous, stabilized economic organization, is one for which the school must assume a major share of the responsibility. Had the schools attacked our basic problems by a realistic approach in the sphere of geography, we might well have avoided the pitfalls which have led to the present chaotic state of affairs. The conservation and proper utilization of such natural resources as forests, soil, water, and minerals are vital to the existence and continuance of human life in a given area. What could be more logical than to have a thorough survey made by the schools of a district, of its local resources, of their conservation, and of the most efficient means of utilization.

That which applies to the community and the region applies in an even greater extent to the nation. Not only are the maintenance and effective conversion of our natural wealth the cornerstone of our continuing leadership among the nations, but a more acute awareness of the tremendous potentialities of our country would constitute a potent factor in promoting the ideals of loyalty and patriotism. A keen insight into the resources, industries, and needs of the different parts of the nation would go far toward alleviating sectional prejudice and misunderstanding of the kind, for instance, which brought on our Civil War. A common understanding of the problems confronting the diverse sections and occupational groups of our country would contribute much toward an equitable solution of our economic and social problems and toward the promotion of national unity.

BEFORE many years have passed, the present younger generation of Americans will possess an opportunity unique in the history of the world to wield a decisive and perhaps permanent influence on the course of human progress. Since this war has ended in complete victory for the United Nations, the United States emerges not only as the most powerful nation on the globe but, in many respects, as more powerful than the rest of the nations combined. Our unrivaled geographic position, a numerous and highly skilled population, plus a huge industrial plant and a vast storehouse of natural resources form a combination which under intelligent direction will enable American power and influence to be paramount on this earth for generations to come.

It is essential that the majority of American people be made cognizant of our new-born might and instructed to employ it in a constructive manner. In order to accomplish this it is necessary for them to understand and appreciate the geographic foundations upon which our power rests. In a like manner, we must know the factors contributing to the strength or weakness of the other nations, particularly the great powers and those states whose affairs are most intimately involved with our own.

Thus, it is necessary that those who will determine our future course of action have a thorough understanding not only to our nation, but of the entire community of nations. As sovereignty here resides in the people, it is imperative that a comprehensive body of information pertaining to national and international conditions be made available to all. Thus, a study of political, economic, and social geography in the years

immediately preceding the achievement of the voting privilege would seem a forward step on the march toward better government in America and toward the attainment and maintenance of international order in the world.

IGNORANCE in varying degrees may be said to characterize the attitudes of most Americans toward foreign countries and peoples. Not long ago a professor asked an upper division history class for the approximate population of Canada. The estimates ran from one million to one hundred million. If prospective college graduates have such a lack of geographic knowledge, how much greater must be the corresponding need for information which exists among an average group of citizens. Literature and, occasionally, the faulty presentation of elementary geography have been partly responsible for the acquisition of false information regarding other nations of the earth.

It is difficult to understand how anyone can have an intelligent opinion regarding domestic or foreign affairs without positive information regarding the region or peoples involved. To comprehend the present and probable future policies of the Soviet Union, for example, it is imperative that we know not only its history, but the population and its rate of increase, the resources, the possibilities for their development, and the degree of accessibility of that vast land.

The increasing interdependence of our modern world has created a situation which makes geographic knowledge essential to socialized living. It is the task of the secondary schools to present an accurate framework of geographic information in order for our future citizens to make sensible decisions affecting the welfare of their society.

THAT geography can offer much in the way of preparing an individual for positive and rational citizenship cannot be denied. As it is offered today in the elementary schools and colleges the study of geography falls short of its primary purpose, the preparation for sound citizenship.

In the elementary grades, geographic material is nearly immersed in a sea of misinformation and mythological fancy. This is caused partially by the current passion for integrating the social studies with literature. As a result, the student gains many false impressions of peoples and places, which, if retained, must be discarded at a later date. Should the child in the elementary schools acquire some accurate geographical knowledge, it is doubtful if he could retain it long enough for it to be of value in his adult life. In addition, conditions may so change in the intervening years as to render much of his information of little value.

Our colleges are doing splendid work in teaching geography, but the number of students receiving instruction in this subject at the college level is so insignificant as to render it of no great import. Classes in college geography are limited primarily to teachers who, upon graduation, are faced with the nearly insoluble problem of presenting valuable material to immature minds, to youngsters years removed from the time when the knowledge gained can be put to effective use.

We must endeavor to offer geography to the great mass of our youth at a time not too far removed from the attainment of their majority. The elementary schools and the colleges are failing in achieving this objective. Thus it is apparent that the high school by necessity must assume responsibility for the teaching of geography if our political and economic problems are ever to

be attacked by an informed electorate.

Geography, when it is offered today in the high school, is restricted generally to one or two semesters of economic or commercial geography, although some schools are including an intensive study of geography as an answer to world problems. The chief objections to present-day geography courses in the secondary school is their narrowness of scope and the lack of time given over to them.

A four-year course would be the ideal arrangement. The ninth-grade students might make a study of their immediate community, district, or region. In the tenth year could be included a survey of United States geography, and perhaps that of our possessions and Canada. An inclusive study of environmental factors and their effect upon the world's political, economic, and social institutions should occupy the remaining two years of the high school.

There are many ways of arranging the sequence of geography courses, but none will be effective unless sufficient time is allotted for their study.

IF an already crowded curriculum does not permit the inclusion of a comprehensive series of geography courses, then some of the less vital courses must be eliminated. Time spent on some of the physical sciences could be cut down so as to allow our social sciences to overtake and control our machine technology. Music, art, and literature courses might be condensed in order to provide for an enlargement of the geography program. Of what value are arts and literature when the individuals for whom they are designed are deprived by war or economic maladjustment of an opportunity to develop and enjoy an appreciation of them? Many high school subjects now offered are essential for the enjoyment of life; geography is becoming essential to life itself.

UNRRA Establishes Schools for Displaced Persons

More than 200,000 children in Displaced Persons Assembly Centers in Germany are attending school now in a full-scale educational program under the supervision of Walter C. Bergman, Detroit educator who is UNRRA director of D. P. Education in the United States occupation zone of Germany. The program is one of the major features in UNRRA's rapidly expanding welfare services for the displaced persons and nonrepatriables who will remain in Germany throughout the winter.

Many of the children, whose memories of concentration camp life are still fresh or whose parents were slave laborers only a short time ago, are now getting a first taste of childhood experience. Their instructors are former teachers and educated volunteers recruited among the displaced persons by UNRRA.

The displaced persons themselves, anxious to see their children in school, are enthusiastically coöperating in the program, Mr. Bergman reports. At one camp where there were no teachers at all, the D. P.'s told the UNRRA team director of several highly qualified people of their own nationality at a nearby center and requested their transfer. This made another school possible.

The schools range from kindergarten classes through the secondary school level. The Wiesbaden Assembly Center, which has a full-scale high school, even has a gymnasium and a D. P. basketball team.

In contrast to modern classrooms with visual aids and advanced teaching facilities, the schools at the camps often are located in bombed-out buildings without benefit of blackboards, chalk, books, paper or writing materials.

To obtain needed materials and a steady flow of textbooks and teaching supplies, Mr. Bergman is negotiating with military and other authorities. Arrangements include the printing of thousands of textbooks in several languages at German expense and provision by the Military Government of ink and coal for the production of paper.

Some Trends in Secondary Education

By REUBEN R. PALM

As we enter on the postwar period in education, it is important that we take stock of the trends which characterize modern secondary education so that we may know the direction in which we are bound. This service Doctor Palm renders for us in the present article. With regard to the references he includes as footnotes under each of the designated trends, he writes, "You will note that the materials listed are chiefly inexpensive pamphlets issued by educational organizations which any teacher can afford to buy or books and magazines that can be found in almost any library."

Doctor Palm is director of the Division of Secondary Education for the County of Los Angeles. Formerly he served for eight years as a high school principal in the Midwest and for two years as instructor in education and history at Eastern Oregon Normal School. Just recently he has been invited to become a member of the Civic Education Committee of the National Council for the Social Studies for the year 1945.

NOW that the war is over, what about secondary education? Is it going to be radically changed? How will it differ from secondary education of yesterday? These and many other similar questions are heard frequently at educational gatherings. They indicate that many persons think that now that the war has ended secondary education will undergo significant change.

It is difficult to predict with certainty what secondary education will be like in the postwar years, but clues are obtainable if current trends in educational thought and practice are examined carefully.

By *trends* in secondary education we mean *the general direction in which educational theory and practice are moving.* Trends are educational theories and practices that have been adopted and are increasingly being accepted by schools and school leaders, but they are not necessarily accepted or carried out in practice by the majority. Often there is a long period of lag from the beginning of a trend until its acceptance in practice by as many as 50 per cent of schools and school leaders—in one study it was found that this lag ranges from 50 to 100 years. It is this long period of time between the recognition of an educational need until something is done about it that causes many critics to say that our schools generally are fifty years behind the times.

If teachers and administrators are to avoid being called laggards, they must be alert at all times to educational trends, must become familiar with the nature of such trends, must decide which trends are sound and must adopt them in thought and carry them out in practice.

THERE are ten educational trends of which all administrators and teachers should be cognizant because of their implications for postwar secondary schools:

1. *Realization of the Need for Know-*

ing Each Pupil.[1] In order to plan the curriculum, and to decide what methods to use in teaching high school students, educators must know pupils as individuals.

Each pupil is an individual personality with experiences, abilities, interests, attitudes, strengths, weaknesses, and needs that are peculiarly his, or her, own. Administrators have the responsibility of organizing schools and teaching programs so teachers can know their pupils. Teachers have the responsibility of learning what devices and procedures to use which will enable them to know their pupils and to plan instruction accordingly.

2. *Awareness of the Importance of the Psychology of Adolescence.*[2] Secondary schools are attended by most pupils during a period of growth and development known as adolescence. Though it is difficult to determine the points which distinguish adolescence distinctly from the states of childhood which precedes and adulthood that follows, students have during adolescence certain emotions, strains, conflicts, drives, urges, interests, and needs of which administrators and teachers need to be fully cognizant if they are to be able to conduct secondary school programs that are functional for youth.

To know the psychology of adolescence and the methods of teaching needed in working with adolescents, teachers need to know more than just animal and structural psychology—and many educators have studied much of the latter, but very little or none of the former.

Increasingly, secondary school workers need to become familiar with the psychology of adolescence. In-service education and self-directed study of latest information and research in the field of adolescent psychology are evidence of an important trend throughout many secondary schools.

3. *Strengthening of the Relationship between School and Community.*[3] A trend that has been long but slow in developing is resulting in a closer relationship between schools and their communities. In order to develop educational programs that meet adequately the needs of pupils, it is necessary for educators to know the communities in which youth live and to learn techniques and ways of studying a community and working with its people.

4. *Adapting Curriculum and Methods to Needs of Students.*[4] For several years there has been an increasing recognition of the need for secondary school programs that provide for the needs of all youth to the age of 18 or to high school graduation. Curriculum and teaching methods once suitable for a select few are no longer adequate for all. Educators need to become familiar

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1 See the following:
Know Your School, Know Your School Child. Leaflet No. 51, United States Department of Interior, Office of Education, Washington, D. C., 1939; p. 18.
Our Concern—Every Child. Bureau Publication 303, United States Department of Labor, Children's Bureau, Washington, D. C., 1944; p. 84.

2 See the following:
The Personal-Social Development of Boys and Girls: With Implications for Secondary Education. Committee on Workshops, Progressive Education Association, New York City, 1940; p. 243.
Emotion and Conduct in Adolescence, by Caroline B. Zachry and Margaret G. Lighty. D. Appleton Century Co., 1940.

3 See the following:
Know Your Community. Leaflet No. 57, Federal Security Agency, U. S. Office of Education, Washington, D. C., 1941; p. 35.
How to Know and How to Use Your Community. Department of Elementary School Principals, National Education Association, 1201 Sixteenth Street, N. W., Washington, D. C., 1942.

4 See the following:
Planning for American Youth. National Association of Secondary School Principals of the National Education Association, 1201 Sixteenth Street, N. W., Washington, D. C., 1944, p. 64 (based on the Policies Commission volume, *Education for All American Youth*).
Education for All American Youth, edited by G. L. Maxwell. Educational Policies Commission, National Education Association; 1201 Sixteenth Street, N. W., Washingon, D. C., 1944.
High School Methods With Slow Learners. National Education Association Research Bulletin, Volume 21, No. 3, October, 1943; p. 59-87.

with the needs of all youth and with methods of teaching them.

5. *Recognition of Developmental Reading as a Responsibility of All Teachers.*[5] Reading habits and skills which are adequate in elementary schools are not necessarily adequate for the reading necessary if one is to do effective high school work. Improvement of the reading habits and tastes of every pupil, therefore, is a responsibility and an opportunity for all high school teachers who require students to read in connection with their work. Teachers who accept this responsibility will find that even bright pupils often can improve as much in reading ability and attitudes as slow learners.

6. *Understanding of the Contribution of Work Experiences.*[6] The exigency of the war has given impetus to a trend that had been developing slowly before the war, namely, the giving of credit toward high school graduation for work experience in work camp, business, or industry under high school coördination or supervision. The values of work experience for vocational guidance, citizenship, and development of habits of industry and responsibility make it imperative that schools continue the program in peace.

Teachers will need to develop ways of organizing their teaching so it correlates with, or relates directly to, the work experience of pupils.

7. *Increased Attention to Intercultural Education.*[7] One of Hitler's maxims is "Divide and Conquer." Nations most easily divided and conquered are those which have conflicts within themselves and misunderstandings with regard to questions of race, religion, and cultural differences of peoples. These misunderstandings, even in democratic nations, lead to attempts to prevent the full participation of minority groups in social, economic, and political life.

Increasingly, schools are developing programs of intercultural education for the purpose of enlightening youth with respect to the scientific facts of race and the contributions of different religions and cultures to the progress of civilization. Through no one course or teacher can this be brought about. All have a responsibility.

8. *Expansion of Education for International Understanding.*[8] More than thirty nations united in a war against Axis aggression, a union of persons of many differing beliefs, cultures, and races. Following the conclusion of the war, there continues to be need for cooperation and understanding between these nations if another war is to be averted. Already plans are being formulated for a permanent International Organization for Educational and Cultural Development.

All nations will be expected, through

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5 See the following:
Teaching Reading in the Secondary School. Bulletin of the California State Department of Education, Volume 12, No. 3, March, 1943; p. 49.
Reading Instruction in Secondary Schools. National Education Association Research Bulletin, Volume 20, No. 1, January, 1942; p. 48.

6 See the following:
"Evaluating Work Experience," by J. B. McDaniel, *California Journal of Secondary Education*, 19:147-152, March, 1944.
"Work Experience in California Secondary Schools," *California Journal of Secondary Education*, 17:328-353, October, 1942.
"Outstanding Work Experience Programs," *California Journal of Secondary Education*, 17:457-465, December, 1942.

7 See the following:
Race and Cultural Relations: America's Answer to the Myth of a Master Race. Problems in American Life Series, Unit No. 5, National Association of Secondary School Principals, National Education Association, 1201 Sixteenth Street, N. W., Washington, D. C., 1942; p. 60.
The Curriculum As an Integrating Force for Ethnic Variations. Harvard Workshop Series, No. 4, Graduate School of Education, Harvard University, 1944; p. 17.
Probing Our Prejudices: A Unit for High School Students, by Hortense Powdermaker and Helen Storen. Harper and Brothers, 1944; p. 73.

8 See the following:
Education for International Security. Harpers Ferry Conference (Virginia), September, 1943; p. 30.
"Broadening the Curriculum for World Unity," by Reuben R. Palm. *California Journal of Secondary Education*, 19:171-175, April, 1944.

their public schools, to set up educational programs in world citizenship that will contribute to better understanding of peoples and cultures of other nations and to effect ways of securing international coöperation. The major responsibility for education for international understanding will be upon the social studies, but much of it will fall also to teachers of language, literature, music, art, and science.

9. *A Better Articulation of Elementary and Secondary Education.*[9] Increasingly is it being recognized that growth is developmental and that it is a reconstruction of experiences. The learning experiences provided by the school curriculum must be organized, therefore, so that each year the student is in school, be he studying English, mathematics, social studies, or some other field, will reconstruct for him what has preceded and will lay the foundation for what is to follow. Curriculum and course of study development in some subject fields, therefore, necessitates formation of joint committees and joint planning by elementary and secondary school teachers.

[9] *Modern Secondary Education*, by Aubrey A. Douglass. Houghton Mifflin Co., 1938; p. 782.

10. *Increased Teacher Participation in Guidance Activities.*[10] For many educators guidance is thought of as a person-to-person function to be performed by an expert or specialist. This concept of guidance has a place in every high school, but, in and of itself, it is not sufficient.

Increasingly, classroom teachers are being expected also to carry a large share of the person-to-person guidance work of the school. Many are not adequately trained, however, in adolescent psychology and in the techniques of guidance. Teachers will need to strengthen their qualifications through study and through programs of in-service training.

Administrators need to control teaching loads, and directors of guidance programs have the responsibility of making available to teachers the information they need in order to do effective guidance.

[10] See the following:
Reorganizing Secondary Education. Prepared for the Commission on Secondary School Curriculum, by V. T. Thayer, Caroline B. Zachry, and Ruth Katinsky. D. Appleton-Century Co., 1939; p. 483.
Guidance in Educational Institutions. Thirty-seventh Yearbook of the National Society for the Study of Education, Part I, Public School Publishing Company, Bloomington, Illinois; 1938.

National Negro History Week to Begin February 10

The week beginning February 10, 1946, has been designated as Negro History Week, under the sponsorship of the Association for the Study of Negro Life and History.

In explaining the purpose of Negro History Week, C. G. Woodson, director and editor for the Association, writes: "We need not advance an argument to convince you of the necessity of studying all elements of our population in relation to others and others in relation to them. Until we learn what all contributors to our civilization have thought and felt and attempted and accomplished, we are uneducated and, therefore, unprepared to play the rôle of leadership which we have assumed. We must broaden our conception of culture and learn enough about the other fellow to appreciate his point of view. In this way and in this way only can we build a democracy which the world of tomorrow will accept."

Chief purpose of the Association for the Study of Negro Life and History are the following: (1) To promote historical research; (2) To publish books on Negro life and history; (3) To promote the study of the Negro through clubs and schools; and (4) To bring about harmony between the races by interpreting the one to the other.

Current Research in the Field of Secondary Education

Reviewed by WILLIAM A. SMITH

An Analysis of Variables Associated with College Attendance and Scholarship of High School Football Athletes, by Erwin J. Henning. Unpublished doctor's dissertation, University of California, Berkely, 1943; 193 pages.

AS the investigator points out in the introduction to his report, nothing is more puzzling to the foreign observer of American higher educational institutions than the colossal extent of organized athletics. The questions which, in the words of the late Henry S. Pritchett, he is inevitably led to raise, especially after witnessing a major college football game, are:

> What relation has this astonishing athletic display to the work of an intellectual agency like a university?
>
> How do the students, devoted to study, find either the time or the money to stage so costly a performance?

Mr. Henning set out to throw light on a restricted phase of the over-all question having to do with the relationship between athletics and what might be called intellectual endeavors in our secondary and higher institutions. Specifically, he delimited himself to a study of "the influence that participation in high school football has upon college attendance and scholarship."

In advance of the actual study, Henning reviewed and summarized with commendable care and thoroughness the vast literature dealing with the relationship between athletic participation on the one hand and scholastic aptitude and success on the other. In general, the data obtained from this source tend to show: (1) that athletes "are not a definitely inferior group" in such matters as intelligence scores and scholarship, the slightly lower ratings being in part at least due to a lesser representation of very brilliant students among them; (2) that they enter college more frequently and show greater persistence there than nonathletes; (3) that they work up to the limits, even when grades are checked against standard achievement scores, at least as well as nonathletes; and (4) that their enrollment and persistence in college are appreciably influenced by widespread subsidizing. Specifically, the literature points rather consistently to football players as ranking "at or near the bottom of the scholastic scale."

In carrying out his own investigation, Henning secured the records of 2,875 high school students graduating in the years 1935, 1936, and 1937. From this group were selected 220 students who had achieved prominence in interschool football. These were designated as football athletes, and the remaining 2,655 as nonathletes even though some of them might have participated in other forms of athletics.

A comparison of these two groups showed that the former tended to be inferior to the latter in grades earned, measured intelligence, and reading achievement test scores, the difference in the case of the reading scores being sufficiently large to be statistically significant. On the credit side, the foot-

ball athletes averaged one-half unit more college preparatory work than the nonathletes.

The 220 football athletes were thereupon matched with 220 individuals chosen from the group of 2,655 nonathletes. The criteria furnishing the basis for the matching were: school attended, semester of graduation, grade-point ratio earned, average intelligence quotient, average reading quotient as measured by standardized tests in reading, and type of high school load as measured by number of college preparatory units earned. The matching was perfect for the first two criteria, and satisfactory for the remaining ones.

The two groups were then followed into college for purposes of comparison. That the football athletes planned to attend college in significantly larger numbers than the nonathletes was shown by the fact that 28 per cent more of them sent transcripts to colleges and more of them sent transcripts to several colleges. Further evidence of the statistically significant college-proneness of the football athletes appeared in the fact that 15.5 per cent more of them actually entered college. Among those entering college, the nonathletes surpassed the football athletes in high school records, though not to a statistically significant degree.

Once in college, the nonathletes consistently surpassed the football athletes in grade point ratios, proportion receiving degrees, number of semesters in attendance, and the number of honors received, though in no case to a statistically significant degree. Incidentally, the differences in grade point ratios for the two groups were less in college than they had been in high school, showing that the slight inferiority of the football athletes at entrance had not handicapped them in college.

While an analysis of the types of college courses pursued by football athletes and nonathletes shows that the former took slightly fewer technical and commercial courses and relatively more general and cultural courses than the latter, the over-all evidence tends to refute the argument sometimes advanced that football athletes are in search of easy courses.

Since the constituents of the two groups—nonathletes and football athletes—entered various higher institutions, it was possible in each case to compare those who entered the University of California with those entering other institutions. The comparison showed the constituents of the nonathletic group to rank much the same in all institutions. Between the constituents of the football athletic group entering the University of California and those entering smaller colleges featuring football, the comparison revealed an appreciable difference, the latter ranking significantly lower in both high school qualifications and success in college.

In summarizing his findings, Henning says:

> In comparison with other students of equivalent qualifications, high school football athletes (1) go to college in larger numbers; (2) graduate from college in larger numbers; (3) have slightly inferior college and high school records; (4) tend to gravitate to certain colleges emphasizing football.

NEA Adds Adult Service

Adult Education Service is the name of a new division added by the National Education Association during the school year 1945-46. As a part of its service, this new division will give special attention to the education of returning veterans, becoming a clearing-house of information on school programs and services for former soldiers. Leland P. Bradford, formerly chief of training for the United States Federal Security Agency, is to head the division.

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